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LI.—*A Collection of Entozoa, chiefly from Birds, from the Murman Coast.* By H. A. BAYLIS, M.A.

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THE material to be described in this paper was collected by Surg.-Lient. E. A. Cockayne, R.N., while in H.M.S. 'Intrepid' (then serving off the Murman coast), and kindly presented by him to the British Museum. The collection consists chiefly of parasites of birds shot by Dr. Cockayne and his fellow-officers at localities on the Murman coast, Kola Peninsula, Arctic Russia.

18 species of Cestodes are represented (excluding larval forms), 3 of Nematodes, and 1 of Acanthocephala. Of the Cestodes, 5 appear to be new species or varieties, while of several the specific determination remains doubtful.

CESTODA.

A. PSEUDOPHYLLIDEA.

Bothriocephalidæ.

Bothriocephalus bipunctatus (Zed.) (?).

Host: Cottid fish. Yukanski, 29. vi. 1917.

The material consists only of fragments of the strobila, unfortunately without scolices. The width of the segments

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is rather small for *B. bipunctatus*, and the determination is somewhat uncertain.

Abothrium infundibuliforme (Rud.).

Host: Salmon. Yukanski, 11. vii. 1917.

A large number of specimens of this species were found hanging out of, and blocking up, the pyloric appendages of the intestine of the fish.

Plerocercoid Larvæ.

Hosts: Cottid fishes. Yukanski, 29. vi. 1917 and 22. vii. 1917.

Larval forms, apparently of two species of Bothriocephalidæ, occurred in two of the fishes examined. One form (A) has a distinct head with pronounced lateral grooves; two examples of this were found at the surface of the liver. In the other form (B) the head is not distinctly marked off and the suckers are obscure.

B. CYCLOPHYLLIDEA.

Tetrabothriidæ.

Tetrabothrius intrepidus, sp. n. (Figs. 1 & 2.)

Host: *Uria grylle* (black guillemot). Yukanski, 27. vi. 1917.

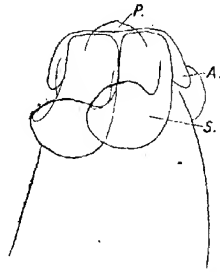
This species is represented only by a single scolex and some fragments. The length of a complete specimen is unknown. The maximum width is 3 mm. The scolex (fig. 1) is 0.6 mm. in width. The suckers are large, dependent, and widely open, curling outwards posteriorly, and resembling shallow basins. Auricular appendages are represented only by a slight finger-shaped lobe (fig. 1, *Al.*) at either side of the scolex, between the dorsal and ventral suckers. Anteriorly the scolex bears a slight papilla (fig. 1, *P.*).

Segmentation begins close behind the scolex; the segments are much wider than long throughout. The genital pores are all situated on the right side. The male and female ducts open at the base of a large muscular cloaca (fig. 2, *Cl.*), on a papilla which projects into it. The cirrus-sac (fig. 2, *C.S.*) is squat, triangular in horizontal section, and has a thick muscular wall.

The testes number about fifty, extending across the dorsal

side of the segment and down on either side of the female organs. The ovary consists of a double rosette of lobes, symmetrically arranged in the middle of the segment. It is transversely elongated, and measures 0.35 mm. across. The yolk-gland is compact and lies in front of the ovary, exactly in the middle line. The shell-gland lies behind the ovary, a

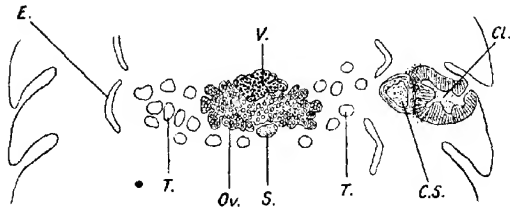
Fig. 1.



Tetrabothrius intrepidus; the scolex.

A., auricular appendage; P., apical papilla; S., sucker.

Fig. 2.



Tetrabothrius intrepidus; horizontal section through a mature segment.

Cl., genital cloaca; C.S., cirrus-sac; E., longitudinal excretory canal; Ov., ovary; T., T., testes; V., yolk-gland.

little towards the pore side. In gravid segments the uterus forms an irregular sac.

Both dorsal and ventral excretory vessels are present, but there appear to be no transverse vessels. The longitudinal musculature is powerfully developed, consisting of more than

fifty stout bundles dorsally and a similar number ventrally. There is no very clear distinction into outer and inner layers. The genital ducts pass between the dorsal and ventral excretory vessels and ventrally to the longitudinal nerves.

This form differs from *T. erosiris* (Lönnberg), which occurs in the same host, in the larger size of the scolex, the slight development of the auricular appendages, the larger number of testes, and other details.

Mesocestoididæ.

Mesocestoides litteratus (Batsch).

Host: *Vulpes vulpes* (red fox). Yukanski, 23. vii. 1917.

This species occurred in considerable numbers in the upper part of the small intestine.

Davaineidæ.

Davainea tetragona (Molin), var. *lagopodis* (var. n.).

Host: *Lagopus mutus* (ptarmigan). Murmansk, Kola Inlet, 2. vi. 1917.

Two specimens of a *Davainea* closely resembling *D. tetragona* (Molin) were found in a ptarmigan killed at Kola Inlet. This species is stated by Clerc* to occur in *Lagopus albus*† in the Ural, but the present examples show certain peculiarities that seem to indicate a distinct variety.

The length of a complete specimen is about 20 cm. and the maximum width 5 mm. The scolex measures 0.3 mm. across. The suckers are oval, their longest diameter (antero-posterior) being about 0.14 mm. The diameter of the rostellum is 0.055 mm. It is armed with a single row of minute hooks, 8 μ long. The suckers are armed with several rows of very small hooklets.

There is a considerable unsegmented neck, as in the typical *D. tetragona*. The segments are much broader than long, except the gravid ones near the posterior end. The transverse excretory vessels are very wide, often appearing as wide as the medullary portion of the segments between them.

The genital pores are unilateral; the cirrus-sac is small (0.15 mm. long), but muscular. The vas deferens is considerably coiled, but, as a whole, pursues a fairly straight

* Bull. Soc. Oural. Sci. nat. xxx. 1910, p. 123.

† The bird referred to as *L. albus* seems more likely to have been *L. mutus*. The former, as I am informed by Mr. C. Chubb, is an American form, though it ranges into Scandinavia and Northern Russia.

course towards the middle of the segment. The testes are very numerous (about one hundred), extending throughout the medullary parenchyme on either side of the female glands. The ovary consists of two symmetrical bunches of lobes situated in the middle of the segment. The yolk-gland is situated at the back of the segment. The shell-gland is a conspicuous organ lying between the ovary and the yolk-gland. The vagina runs fairly straight from the genital pore to the middle of the segment, its inner end, functioning as a receptaculum seminis, persisting in the gravid segments after most of the other organs have disappeared. The oviduct becomes very wide before opening into the uterus, running vertically for the last portion. The uterus appears at first as a transverse tube, but afterwards disappears, and numerous egg-capsules are formed.

The most important character distinguishing this form from the typical *D. tetragona* is the much larger number of testes (twenty to thirty in *D. tetragona*, about one hundred in the present variety).

Dilepinidæ.

Lateriporus teres (Krabbe), Fuhrmann, 1907.

Host: *Somateria mollissima*. Yukanski, 8. vi. 1917; Pet-schenga, 24. ix. 1917.

This species seems to be fairly common in the eider-ducks in this region. It was met with in two individuals obtained at the first-given locality, and in another at the second.

Choanotænia paradoxa (Rud.), Clere, 1903.

A single specimen, probably referable to this species, was obtained from a red-necked phalarope (*Phalaropus lobatus*) at Yukanski, 10. viii. 1917.

Choanotænia sp. (?).

(Not *Ch. borealis* (v. Linst., 1905), Fuhrmann, 1908.)

Host: *Clangula hyemalis* [= *Harelda glacialis*] (long-tailed duck). Yukanski, 8. vi. 1917 and 10. vi. 1917.

There are several fragments of what appears to be a species of *Choanotænia*, or possibly *Anomotænia*, obtained on different occasions from two long-tailed ducks. Unfortunately, however, there is only one scolex, and this has lost its rostellum, so that the characters of the hooks, so important

for diagnosis, are unknown. The species differs from *Ch. borealis* (v. Linst.) in having forty-five to forty-eight testes, instead of twenty-five, in each segment, and also in having a smaller scolex (0.43 mm. across at the suckers, instead of 0.67 mm.).

Anomotenia campylacantha (Krabbe), Zschokke, 1903.

Host: *Uria grylle*. Yukanski, June and July 1917.

Numerous examples of a worm which may be referred to this species occurred in several black guillemots, associated in one case with *Tetrasthirus intrepidus*. They usually occupied the upper part of the intestine, just below the gizzard.

Anomotenia micracantha (Krabbe), Zschokke, 1903.

Host: *Uria grylle*. Yukanski, 22. x. 1917.

A second and rather larger species, which I refer to *A. micracantha*, occurred in considerable numbers in one of the same birds in a similar position to the preceding form.

Monopylidium arcticum, sp. n. (Figs. 3 & 4.)

Host: *Tringa maritima* (purple sandpiper). Yukanski, 7. viii. 1917.

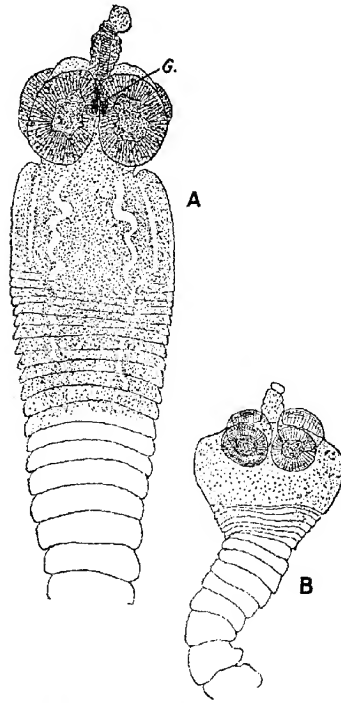
This is a slender little worm, about 3.5 cm. long when fairly extended. The maximum width (at the posterior end of the strobila) is about 0.5 mm. A peculiar feature is the tendency of the neck to be very much contracted in the longitudinal direction (fig. 3, B) and very wide just behind the scolex. Nearly all the specimens show this contraction, which gives them, to the naked eye, the appearance of having a very large, flattened scolex.

The scolex (fig. 3, A) measures about 0.24 mm. across the suckers, the diameter of the latter being 0.12 mm. The rostellum has a mushroom-shaped end and a fleshy and muscular stalk. There is a single row of about thirty (?) hooks, measuring about 15 μ in length. There is a pair of glandular (?) structures (fig. 3, A, G.) at the base of the rostellum, in the substance of the scolex.

The strobila contains some eighty segments, which are considerably longer than broad, except those near the anterior end. They gradually increase in length towards the posterior end, some of the gravid segments being fully three times as long as broad. The longitudinal musculature is very well developed. Mature segments (fig. 4) begin to appear at

about the fiftieth. The genital pores are situated near the front of the segment and irregularly alternating. There is a muscular genital atrium (fig. 4, *G.A.*) into which the cirrus-

Fig. 3.



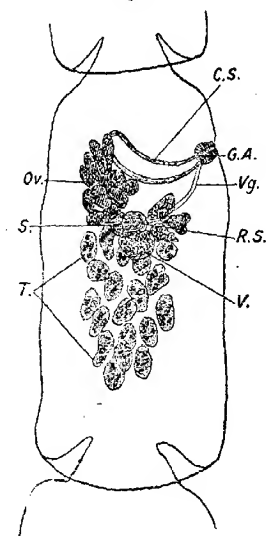
Monopygidium arcticum; the scolex and anterior end of the strobila.

- A. An example with moderately contracted neck; *G.*, paired glands (?) at base of rostellum.
- B. An example (less highly magnified) showing marked contraction of the neck.

sac and vagina open. The cirrus-sac (fig. 4, *C.S.*) is very long and narrow, measuring 0.175 mm. in length and 0.035 mm. in width. It curves forwards from the genital

atrium towards the anterior border of the segment, and ends at, or even beyond, the middle line. The testes (fig. 4, *T.*) number about twenty, and occupy the posterior half of the segment. There is a much-coiled vas deferens. The ovary consists of two groups of lobes, the larger group being on the aporal side. Between the two portions of the ovary there is a large rounded receptaculum seminis (fig. 4, *R.S.*); close to

Fig. 4.



Monopylidium arcticum; semi-diagrammatic drawing of a mature segment (from a whole preparation).

C.S., cirrus-sac; *G.A.*, genital atrium; *Ov.*, ovary; *R.S.*, receptaculum seminis; *S.*, shell-gland; *T.*, testes; *V.*, yolk-gland; *Vg.*, vagina.

this is the shell-gland (fig. 4, *S.*), and behind both these the compact yolk-gland (fig. 4, *V.*). There are only a few ripe segments at the posterior end of the strobila. There is no definite uterus, the ova being embedded singly in the parenchyme. The onchospheres are about $20\ \mu$ in diameter.

This form differs from *M. cinguliferum* (Krabbe) in a number of points, notably in its smaller number of testes,

while it is readily distinguished from *M. macracanthum*, Fuhrm., by the much smaller size of its hooks. Both these species occur in closely related hosts.

Monopyliidium stercorarium, sp. n. (Figs. 5-7.)

Host: *Stercorarius pomarinus* (pomatorhine skua). Yukanski, 22. vi. 1917.

This is a comparatively short worm, measuring 2.5-3 cm. in length. The maximum width is about 0.8 mm. (near the posterior end). The number of segments is rather small (about ninety).

Fig. 5.

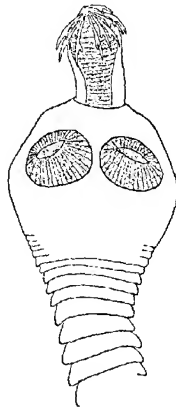


Fig. 6.

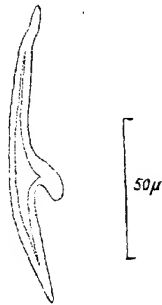


Fig. 5.—*Monopyliidium stercorarium*; the scolex.

Fig. 6.—Ditto; hook from the rostellum.

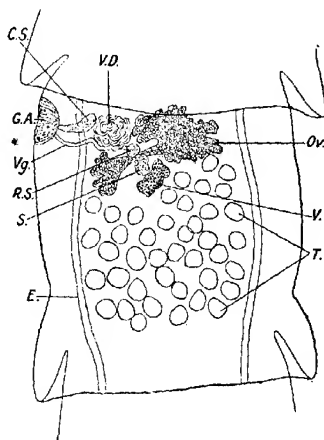
The scolex (fig. 5) measures about 0.4 mm. across, and the suckers are 0.18 mm. in diameter. The rostellum is rather long and stout, and is armed with a single crown of fourteen (?) very large hooks, 110 μ in length (fig. 6). The long roots of the hooks meet at the apex of the rostellum.

Segmentation begins immediately behind the scolex. The anterior segments are broader than long; soon, however, they become squarish, and posteriorly they are much longer than broad. Rudiments of genital organs begin to appear at

about the thirtieth segment, and young mature segments begin at about the sixtieth. There may be about eight or nine gravid segments at the posterior end, but the number is never large.

In a mature segment (fig. 7) there are about forty testes, occupying the posterior two-thirds of the segment, and extending forwards on the aporal side of the ovary. The genital pores are irregularly alternating and situated near

Fig. 7.



Monopylidium stercorarium; semi-diagrammatic drawing of a mature segment (from a whole preparation).

C.S., cirrus-sac; E., excretory canal; G.A., genital atrium; Ov., ovary; R.S., receptaculum seminis; S., shell-gland; T., testes; V., yolk-gland; V.D., vas deferens; Vg., vagina.

the anterior corner of the segment. There is a muscular atrium (fig. 7, G.A.) into which the male and female ducts open. The cirrus-sac is small, measuring 0.15×0.037 mm. The vas deferens is long and much coiled, a large mass of its coils (fig. 7, V.D.) just between the cirrus-sac and the ovary functioning as a seminal vesicle. The ovary consists of a larger and a smaller portion, the former being on the aporal side. Behind it is the yolk-gland, and between this and the

narrow middle portion of the ovary is a rather large shell-gland. Just in front of the shell-gland is a small rounded receptaculum seminis.

There is no definite uterus in the gravid segments, the ova being scattered singly in the parenchyme. The onchospheres measure about $25\ \mu$ in diameter.

This species bears an exceedingly close resemblance to *Choanotenia porosa* (Rud.) in many respects, but the hooks are of a slightly different shape, the cirrus-sac is much smaller, and the uterus is not sac-like. The small number of segments is also a feature not characteristic of *Choanotenia*.

Hymenolepinidæ.

Hymenolepis microsoma (Crepl.), Cohn, 1901 (?).

Host: *Oedemia nigra* (common scoter). Yukanski, 8. vi. 1917.

A number of fragments, unfortunately without scolices, which probably belong to this species, were the only parasites found in this bird.

Hymenolepis spp. A and B.

Host: *Clangula hyemalis* [= *Harelda glacialis*] (long-tailed duck). Yukanski, 8. vi. 1917.

The collection includes portions of about three specimens of species of *Hymenolepis* from this bird. Apparently at least two species are represented, but the material is too fragmentary for precise determination. One specimen has a very small scolex, with a little button-like rostellum, apparently unarmed. The scolex measures 0.096 mm. across and the suckers only 0.03 mm. in diameter. This may be called species A. In the mature segments the three testes are arranged in a transverse row, and the fan-shaped ovary lies between the middle and aporal testes. The entire specimen is about $4\frac{1}{2}\text{ cm.}$ in length, and the maximum width is about 1.5 mm.

Another specimen, which may be called species B, has a larger scolex with a more typical rostellum, which was apparently provided with hooks; these, however, have all been lost. The ovary, in this case, lies between the middle testis and that on the pore side.

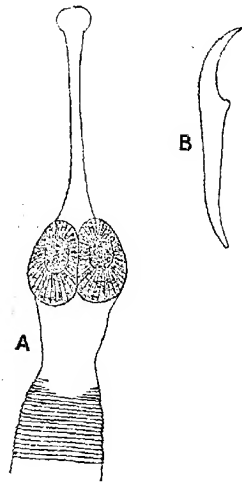
Hymenolepis sp.

Some fragments of the strobila of a *Hymenolepis* also occurred in one of the eider-ducks (*Somateria mollissima*) at Yukanski, together with an *Aploparaksis* to be described below; but the absence of a scolex makes determination difficult or impossible.

Aploparaksis filum (Goeze), Clerc, 1902.

A headless fragment, perhaps referable to this species, was taken from a purple sandpiper (*Tringa maritima*) at Yukanski, 5. vi. 1917.

Fig. 8.

*Aploparaksis murmanica*.

A. The scolex, with extended rostellum.

B. Hook from the rostellum, much more highly magnified.

Aploparaksis murmanica, sp. n. (Fig. 8.)

Host: *Somateria mollissima*. Yukanski, 8. vi. 1917; Petschenga, 24. ix. 1917.

This is a very small and delicate species, which was

present, usually in considerable numbers, in all the eider-ducks examined.

An entire specimen measures 1 to $1\frac{1}{2}$ cm. in length, with a maximum width of 0.36 mm. The scolex (fig. 8, A) is flattened dorso-ventrally, and measures 0.22–0.27 mm. across at the suckers and about 0.15 mm. in thickness dorso-ventrally. The suckers are very large, meeting in the middle line. The rostellum is long, slender, and proboscis-like, measuring about 0.35 mm. in length when fully extended. At the end it expands into a bulb. The hooks (fig. 8, B), which were only seen in specimens with the rostellum retracted, are ten in number and measure $65\ \mu$ in total length. They are of an unusual shape, having a very long "dorsal" and a greatly reduced "ventral" root.

Segmentation begins close behind the scolex. In a complete specimen there are some three hundred segments, which are broader than long throughout. The cirri, which are usually extruded, are spiny, and, when fully extended, measure about 0.05 mm. in length. The onchospheres measure about $20\ \mu$ in diameter.

Of the species of *Aploparaksis* hitherto recorded from Anseriform birds, this species is easily distinguished from *A. jurcigera* (Rud.) and *A. birulai*, v. Linst., by the size and shape of its hooks. The hooks of *A. fuligulosa*, Solowiov, 1911, are undescribed, but the latter form has a smaller scolex and much longer cirri, among other points of difference. The description of *A. elisæ*, Skrjabin, 1915, I have unfortunately been unable to consult. *A. cirrosa* (Krabbe), which occurs in Lariformes, has hooks only $22\ \mu$ in length.

NEMATODA.

Ascaridæ.

Ascaris capsularia, Rud.

Hosts: Cottid fishes. Yukanski, June 1917.

This immature Ascarid, according to views put forward elsewhere by the writer*, is the larval form of *Ascaris decipiens*, Krabbe, which occurs as an adult in seals. The young forms are found in fishes of various genera and families, usually coiled up like watch-springs in capsules under the peritoneum.

The present examples came from various Cottid fishes, the precise determination of which is unknown. They agree in almost all respects with the description previously given*,

* 'Parasitology,' viii. no. 2, 1916, p. 360.

but the two portions of the œsophagus are, relatively to the whole body, considerably shorter, especially the anterior portion, which is only about half the length there given. Thus, in a specimen about 14 mm. long the anterior part of the œsophagus measures only 1.02 mm., the posterior part 0.78 mm., and in a 37 mm. specimen the two parts measure 1.8 mm. and 0.8 mm. respectively. This seems to indicate that a good deal of variability exists.

Dr. Cockayne informs me that these worms were not found, as usual, in capsules, but were embedded in the liver of the fishes or just under its covering membrane. When the liver was placed in a dish, they sometimes wriggled out quite freely.

Ascaris sp.?

From one of the fishes, among examples of *A. capsularia*, there is one small larval Ascarid of another species. It is about 10 mm. long, having a head with three rudimentary lips and a boring-tooth, and a gradually tapering tail about 0.2 mm. long, without a tail-spike. There is a conspicuous excretory cell running back to about 1.8 mm. from the anterior end. The œsophagus is about 1 mm. long, and there appear to be no œsophageal or intestinal diverticula.

Spiruridæ.

Streptocara sp. [*S. pectinifera* (Neumann)].

Host: *Uria grylle*. Yukanski, 27. vi. 1917.

Neumann, in 1900, described a small nematode from the common fowl and guinea-fowl under the name of *Spiroptera pectinifera*. This has been made the type of a new genus—*Streptocara*—by Railliet and Henry*.

The present collection contains a single female specimen of a worm which evidently belongs to the same genus, and answers so closely to the description of *S. pectinifera* that it may be specifically identical. The absence of a male, however, renders determination uncertain and description comparatively worthless. The specimen in question was found in the crop of the host. If the species is identical with *S. pectinifera*, it is remarkable that it should occur in hosts so distantly related as the common fowl and the black guillemot.

* Compt. rend. Soc. Biol. lxxiii. 1912, p. 622.

ACANTHOCEPHALA.

Polymorphus minutus (Goeze), Lühe, 1911
[= *Echinorhynchus polymorphus*, Bremser].

Hosts: *Somateria mollissima*, Petschenga, 24. ix. 1917.
Uria grylle, Petschenga, 22. x. 1917.

The latter bird appears to be a new host for this species, which occurs chiefly in various species of ducks and in some other aquatic birds.

LII.—*The Classification of the Mongooses* (Mungotidæ).
By R. I. Pocock, F.R.S.

IN 1916 (Proc. Zool. Soc. 1916, pt. i. pp. 349-374) I published a comparative study of the principal external characters of the mongooses, granting this group the rank of a family Mungotidæ of the *Eluroïd*, *Herpestoid*, or *Mungotoid* section of the *Carnivora**.

In this paper I restored to use certain generic names, such as *Atilax*†, *Ichneumia*, and *Ariela*, which do not appear in their generic significance in modern treatises on the group, the two first being regarded as synonyms of *Mungos* (*Herpestes*) and the last as a synonym of *Crossarchus*. Since the justification for their resuscitation was not definitely stated in systematic form, and since the reason for thinking the mongooses should rank as a family of the Mungotidæ rather than as a subfamily of the Viverridæ, according to the generally adopted practice, was not declared at all, I propose in this paper to make good those defects.

* The term *Herpestoidea* was proposed by Winge to replace *Eluroidea* on the grounds that the generic name *Elurus* unfortunately stands for one of the *Procyonidæ* belonging to the *Cynoid* or *Arctoid* section of the order. But since *Herpestes*, being preoccupied, no longer stands for the typical mongooses, *Mungos* is used instead. Similarly, *Mungotinæ* has taken the place of *Herpestinæ*. Logically, therefore, *Mungotoidea* should be preferred to *Herpestoidea* if, in accordance with Weber, we follow Winge in discarding the title *Eluroidea*.

† *Atilax*—or *Athylax*, as it should have been spelt—means pouchless, and was given by Cuvier to the marsh-mongoose, on the supposition that this animal has no anal sack. As I have shown, however (*op. cit.* p. 363), the sack is well developed in this genus.

Family *Mungotidæ*.

Mungotoid Carnivora distinguished by the combination of a number of positive and negative characters, of which the principal are:—

The secretion of the *anal glands*, the orifices of which are outside the anus, is discharged into a nearly naked, glandular, cutaneous sack capable of being closed by the juxtaposition of the upper and lower halves of its thickened rim.

Perineal scent-gland absent in both sexes.

Vulva close beneath lower rim of anal sack.

Prepuce close to scrotum.

Glans penis short, with orifice on its lower surface; baculum present.

Feet with fossorial, non-retractile, usually long claws, and pollex and hallux, when present, arising just above the plantar pad.

Ear rounded, small or moderate, without marginal bursa, and with antero-internal ridge (intratragus) curving abruptly backwards beneath the supratragus, and high above the intertragal notch.

Resembling the *Hyænidæ* and *Cryptoproctidæ* in the possession of an anal sack and the absence of preputial scent-gland, but differing from them in the smallness of the penis, the proximity of the prepuce to the scrotum, etc. The last character mentioned and the absence of the preputial gland distinguish them from the *Viverridæ* (*Viverra*, *Paradoxurus*, etc.). They approach the *Galidictidæ* in the structure of the feet and in cranial characters, but differ in the presence of the anal sack, the absence of the perineal gland and of the bursa in the ear, and in the presence of an alisphenoid canal or of a groove representing it.

Characters and Classification of the Genera of Mungotidæ.

In 1864, and in papers published after that date, Gray made use of the presence and absence of the naked area of skin cleaving the upper lip as a character of primary importance in classifying the mongooses. He even divided them into two families—the *Herpestidæ* and *Rhinogalidæ*—on that basis.

Thomas also chose this as the leading feature in grouping the genera of African mongooses, the number of toes coming next in order, then the premolar teeth, and, finally, the hairiness of the sole of the hind foot (P. Z. S. 1882, pp. 62-63). But whether the analytical key compiled on those lines

expressed his views regarding the true affinities of the genera, or whether the arrangement, in its entirety or in part, was merely a matter of convenience for the determination of the genera, I am not sure.

Mivart's classification was published in the same year as that of Thomas (P. Z. S. 1882, p. 185). He pointed out that the genera may be arranged in various ways, *i. e.*, according to the number of anal glands, the number of digits, the number of teeth, and the presence or absence of the subnasal groove; and it is quite clear, I think, that Mivart had no preference for one category over another. The use he made of the anal glands has already been discussed (P. Z. S. p. 366, 1916). With regard to the other groups, by the number of toes *Suricata* is ranged alongside *Bdeogale*, by the character of the upper lip it falls with *Rhynchogale* and *Crossarchus*, by the number of premolar teeth it is associated with *Helogale* and *Crossarchus*.

Suricata has been selected here as a test of Mivart's proposed classification, because, in my opinion, the simple structure of the ear in that genus shows that it cannot be closely affiliated with any other genera of mongooses, all of which have complicated highly specialized ears; and this conclusion further suggests that the suppression of the divisional line of the upper lip may be an independently acquired resemblance between *Suricata* and *Crossarchus* or *Rhynchogale*.

From a comparison of the genera, admitted in my paper in 1916, both mutually and with those of the subfamilies of the Viverridæ, it may be assumed as a working hypothesis that the immediate ancestor of the mongooses possessed the following characters:—

1. The snout was of moderate length, and a naked grooved strip of skin (*philtrum*) extended from the rhinarium, which had a deep infranarial portion, to the edge of the upper lip.

2. The cheek-teeth, consisting of four premolars and two molars above and below on each side, were of a crushing and cuspidate rather than of a shearing and piercing type, with the upper carnassial (*pm*⁴) set well in front of the posterior angle of the cheek where the inferior edge of the zygoma rises, thus leaving space behind for two well-developed molars, the last molar of the mandible being also well developed*.

* If it be claimed, as it may be claimed, that the ancestral form had the specialized carnivorous dentition of the kind seen in *Mungos*, then that genus, setting aside the ear, differs but little from the hypothetical progenitor of the group, and the more generalized omnivorous dentition of such forms as *Ichneumia* and *Crossarchus* has been secondarily acquired. A similar argument applied to the subfamilies of Viverridæ will involve

3. The ear had the external portion of the pinna small as compared with the depression containing the cartilages, and there was no marginal bursa. Of the cartilages, the supratragus was rod-like and the prominence of the antero-internal ridge (*intratragus*) ended high above the intertragal notch leading to the inferior auditory meatus.

4. The feet were semiplantigrade and pentadactyle, with the pollex and hallux inserted above the plantar pad, which was trilobate, not quadrilobate; the four main digits, armed with long fossorial claws, were united by interdigital webs extending to the proximal ends of the small digital pads; the fore feet were naked back to the carpal pad and the hind feet up to and possibly including the heel.

5. The orifices of the anal glands were outside the anus, and their secretion was discharged into a nearly naked glandular cutaneous sack with a thickened rim and capable of being closed by the juxtaposition of the upper and lower halves of this rim.

6. The vulva was only a short distance below the lower edge of the anal sack and the penis was short and situated close to the scrotum, there being no trace of a preputial gland between the penis and scrotum in the male or between the anal sack and the vulva in the female.

None of the existing genera conforms precisely to this type. Apart from *Suricata*, to be considered later, all of them have ears more complex in construction, owing to the formation of the two valvular laminae.

Of the genera with complex ears, *Mungos* (type *mungo*), in a broad sense, with its pentadactyle naked feet, well-webbed digits, and cleft upper lip and moderate snout, agrees with the primitive type, but it differs therefrom in its carnivorous dentition, the upper carnassial (*pm*⁴) being large and set back

the conclusion that the specialized carnivorous dentition of *Genetta* and *Linsang* preceded in evolution the generalized omnivorous dentition of *Paradoxurus* and *Fossa* respectively. Also that the similarity between the teeth of *Genetta* and *Mungos* in number, position, and form is a character inherited almost unchanged from a common *Eluroid* ancestor. I believe, on the contrary, that it is a purely adaptive resemblance, and that the carnivorous type of dentition, attested more particularly by the retrogression of the upper carnassial (*pm*⁴), accompanied by reduction in the size and importance of the two molars behind it and of the first premolar, has been independently acquired several times over within the limits of the *Eluroides*; and that the extraordinarily varied types of dentition met with in this group have been derived sometimes by elaboration, sometimes by degeneration from some such type as that of the typical Canidae, in which the upper carnassial is set far forwards, leaving space for two fairly large molars behind it.

almost to the angle of the cheek, the two molars being reduced so as to fit into the short dental area behind it. The lower carnassial (m^1) is correspondingly large and the last molar quite small. The first premolar, always small and sometimes absent, is evidently a practically functionless tooth, but, when absent, its former position is marked by the persistence of the space between the canine and the second premolar.

Helogale (type *parvula*) may be regarded as a dwarfed *Mungos*, in which the diastema has closed up by the shortening of the jaw.

Atilax (type *paludinosus*) is related to *Mungos*, but has very specialized feet, as is testified by the suppression of the interdigital webs. The slightly more forward position of the upper carnassial and the larger size of the two molars suggest its being an offshoot from the *Mungos* + *Helogale* stem before the retrogression of the carnassial was completed. The exceptional massiveness of the teeth and jaws are probably an adaptation for crushing the shells of the river-crabs on which it feeds to a great extent.

Ichneumia (type *albicauda*) has teeth* of a more generalized type than *Mungos*, and in that particular comes nearer the hypothetical primitive form, but it differs therefrom at least in the hairiness of the hind feet and more digitigrade gait. The depth of the upper lip below the rhinarium is also no doubt a specialized feature.

Bdeogale (type *crassicauda*) shows many dental resemblances to *Ichneumia*, as Thomas pointed out†. Specialization of the feet, however, is carried a stage further than in that genus, as is shown by the shortening of the four main digits and the suppression of the hallux and pollex.

* Of the teeth of *Ichneumia albicauda* Thomas wrote in 1882:—"Teeth more rounded than in the members of the typical subgenus [*Mungos*]. Last molars above and below proportionately much larger . . . the lower one with a well-marked extra cusp between the usual ones, so that there are five cusps in all." To this it may be added that the first molar of the upper jaw is nearly as large as the carnassial (pm^1), though lower crowned, and occupies the position of the carnassial in *Mungos*, being inserted well in front of the superjacent base of the zygomatic arch.

† He wrote, "Of all the mongooses *I. albicauda* [*Ichneumia*] seems to be most nearly allied to true *Bdeogale*, strongly resembling the species of that genus in . . . the proportionally large size of the last molar, and, most of all, in the presence of the median middle external cusp to the last molar, a character in which *Bdeogale* differs from all other mongooses except the present species and those of the very distinct genus *Crossarchus*."

*Rhynchogale** (type *melleri*) was associated by Gray with *Crossarchus* and *Suricata*, and provisionally left in that category by Thomas. It appears to me to be more nearly related to *Ichneumia* and *Bdeogale*, despite the suppression of the groove on the upper lip.

In position and relative size the teeth are not at all unlike those of *Ichneumia* and *Bdeogale*, although the upper carnassial is a little more forward. Their chief peculiarity lies in the flatness of the crowns of the molars, probably an adaptation to a frugivorous diet †. The twist of the lower dental row is not much, if at all, more marked than in *Bdeogale*, and the same is true of the concavity of the palate. The mesopterygoid fossa is more forward than in *Ichneumia* and *Bdeogale*, but the bullæ, which are more inflated posteriorly than in *Bdeogale*, do not surpass those of *Ichneumia* in that respect. The feet are pentadactyle and hairy as in *Ichneumia*. The absence of the groove below the rhinarium is a distinctive feature of *Rhynchogale*, which appears also to have a longish snout; but this latter feature seems to be foreshadowed by the long upper lip of *Ichneumia*. On the evidence I think the genus may be regarded as a specialized form of the *Ichneumia* + *Bdeogale* group of genera.

The exact position of *Cynictis* (type *penicillata*) and *Paracynictis* (type *selousi*) is doubtful, but there are indications perhaps of closer kinship with *Ichneumia* than with any other genus, although the relationship is not close. Nevertheless, the large ears of *Cynictis* are foreshadowed in *Ichneumia*, and, as in that genus, the fore foot is hairy down to the carpal pad and the hind foot down or almost down to the plantar pad; but the suppression of the hallux in *Cynictis* and of both pollex and hallux in *Paracynictis*, and the reduction in depth of the interdigital webs mark the feet as more specialized than in *Ichneumia*, though possibly in the greater length of the claws they are more primitive. Specialized features in the skull are its shortness, a character correlated, judging from *Suricata*, with stronger postorbital bars and

* I have seen no fresh or spirit-preserved material of this genus apart from a newly born kitten found by White at Zomba and preserved in the British Museum. The anal sack is well developed, but the most remarkable feature about the specimen is the enormous depth of the upper lip beneath the rhinarium, giving an unusually thick aspect to the muzzle. The rhinarium, moreover, is set upon the summit of the muzzle, and has an upward, not a forward aspect, almost as in *Cynogale*. Since I do not know the condition of the muzzle in the young of other genera of mongooses, a simple record of the facts must suffice.

† White found the stomachs of *Rhynchogale* filled with fruit (P. Z. S. 1894, p. 139).

more arched zygomata, and the inflation of the anterior chamber of the bulla, coupled with the large perforation close to the tympanic bone.

As in *Ichneumia*, *Mungos*, and others, the *foramen rotundum* opens into the alisphenoid canal, probably a primitive feature. The teeth of the upper jaw are somewhat more sectorial than in *Ichneumia*, as is shown more particularly by the narrower palatal portions of the two molars.

Ariela (type *fasciata*), with some points of resemblance to *Mungos* in its semiplantigrade pentadactyle feet, has nevertheless a more generalized dentition. The highly developed anal sack and absence of groove on the snout are specialized features. In one character connected with the skull it differs from all the genera hitherto considered (? *Rhynchogale*)—namely, in the opening of the *foramen rotundum* direct into the temporal fossa and not into the alisphenoid canal, the anterior aperture of the latter being situated alongside that orifice and separated therefrom by a narrow bony partition.

Crossarchus (type *obscurus*), resembling *Ariela* in the particular last mentioned, has a less specialized anal sack and a more specialized snout.

Suricata (type *suricata*) has always been admitted to hold an isolated position amongst the mongooses, and the now ascertained differences in the structure of its ear enhance the isolation.

Generically it may be distinguished from the rest of the family by a complex of associated characters, like the general form of the skull, the elongated snout, undivided upper lip, tetradactyle feet, and naked tarso-metatarsus. The shape of the skull, with its bowed zygomata and complete and stout postorbital bars, recalls in a measure that of *Cynictis*; but the great difference in the form of the bullæ, apart from other features, precludes the idea of near affinity between the two genera. The long snout and undivided upper lip, resembling those features in *Crossarchus*, are likely enough to be purely adaptive resemblances; but in the skull there is one significant similarity, namely, the situation of the *foramen rotundum* alongside the anterior orifice of the alisphenoid canal and close to the sphenoidal fissure—a character restricted to *Ariela*, *Crossarchus*, ? *Rhynchogale*, and *Suricata*, so far, at all events, as mongooses are concerned. I think it is a tenable hypothesis that *Suricata* is a highly specialized offshoot of the *Ariela* + *Crossarchus* stock of this family. In that case, the ear of *Suricata* may be regarded as secondarily simplified. Nevertheless, a comparison between this ear and that of the Mascarene Galidictine genera forcibly suggests

simplification from that type of organ found in the latter group. In the present state of our knowledge it seems to me that no satisfactory conclusion can be reached on this point. But even if kinship between *Suricata* and *Crossarchus* be admitted, it must be remembered that the former differs from the latter more than *Crossarchus* differs from other genera of mongooses.

The main characters peculiar to the skull of *Suricata* are the following:—

1. The plane of the base of the skull is inclined at an obtuse angle to the plane of the palate. In other genera these two planes are subparallel.
2. The bullæ are nearly as wide as long, very flat, and project only slightly below the occipital condyles, which are situated between their postero-superior portion. In other genera the bullæ are much longer than wide, inflated, and project some distance below the condyles.
3. The ridge of the mastoid extends on the outer side of the bulla below the inferior edge of the auditory meatus.

These characters, coupled with the difference in the structure of the ear, justify the erection of *Suricata* to the rank of a subfamily—the *Suricatinæ*,—the rest of the genera constituting the *Mungotinæ*.

Analytical Key to the Genera of Mungotidæ.

The construction of an analytical key to the genera of this family is simplified by giving a foremost place to the number of digits and to the structure of the upper lip; but since the adoption of that course leads, in my opinion, to artificial affiliation, I have attached a secondary importance to those characters:—

- | | |
|---|---------------------|
| A. Supratragus a simple ridge with no valvular flap above it; skull-characters as enumerated above | Subfam. SURICATINÆ. |
| Teeth as under <i>a'</i> below, pollex and hallux suppressed, upper lip uncleft by philtrum | <i>Suricata</i> . |
| B. Supratragus large and valvular, with a valvular flap just above it. | Subfam. MUNGOTINÆ. |
| a. Dentition sectorial, upper carnassial (<i>pm</i> ⁴) dominant, set back so that its posterior angle is close to the base of the malar arch, its outer edge forming an obtuse angle with that of <i>m</i> ¹ , most of which is | |

- behind that point; (upper lip shallow, cleft; digits 5-5).
- b. Digits 2 to 5 always united by a web which projects beyond the margin of the plantar pad.
- c. Either a space or pm^1 intervening between the upper canine and pm^4 .
- c'. No space between upper canine and pm^4 ; pm^1 suppressed *Mungos* *.
- b'. Digits 2 to 5 separated down to plantar pad, owing to suppression of the webs present in other genera *Helogale*.
- a'. Dentition more generalized, rather crushing than sectorial, upper carnassial (pm^4) set forwards so that its posterior angle is well in advance of the root of the malar arch, the whole or practically the whole of m^1 being also in advance of that point, the line of the cheek-teeth forming a much more even curve at the junction of pm^4 and m^1 *Atilax*.
- d. Webs deeper as compared with length of digits; ears moderate or small, with no pocket behind the antitragal ridge; skull elongated, lower; inner portions of upper m^1 , m^2 thick and strong; last lower molar with median external cusp or flat-crowned.
- e. Legs short, semiplantigrade, fore paws broad, with very long claws; at most the heel of the hind foot hairy, ears small and rounded (no groove on upper lip).
- f. Snout short as in *Mungos*, infranarial portion of rhinarium shallow; anal sack complex *Ariela*.
- f'. Snout long, infranarial portion of rhinarium deep; anal sack simple. *Crossarchus*.
- e'. Legs long, digitigrade, fore paws narrow, claws shorter, metatarsus covered with hair almost to the plantar pad, ears longer.
- g. Upper lip grooved, posterior cheek-teeth cuspidate; mesopterygoid fossa set further back. *Ichneumia*.
- h. Pollex and hallux retained *Bdeogale*.
- h'. Pollex and hallux suppressed
- g'. Upper lip ungrooved, posterior cheek-teeth flat-crowned; mesopterygoid fossa set more forwards. *Ithynchogale*.
- d'. Webs very shallow as compared with length of digits, especially between digits 3 and 4, 4 and 5; ears very large for the group, with a small

* I suspect this genus will prove to be divisible into three or more genera when better known.

pocket behind the antitragal ridge * ;
 skull short and high ; inner portions
 of upper m^1 and m^2 slender and weak ;
 last lower molar without median
 external cusp ; (upper lip grooved ;
 metatarsus hairy down to plantar
 pad ; hallux absent).

i. Pollex retained *Cynictis*.

ii. Pollex suppressed *Paracynictis*.

LIII.—On Two new Parasitic Mites (*Myocoptes hintoni*
 and *Psoroptes natalensis*). By STANLEY HIRST.

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Myocoptes hintoni, sp. n.

♀. The minute little *scutum* (at the extreme anterior end of the *dorsum*) angular posteriorly in the middle, but not ending in a slender, median, spine-like process, as in *M. musculus*, Koch, and *M. tenax*, Michael. The new species can also be readily recognized by the four very long hairs (a pair on each side) that are present (on the venter) at the posterior end of the body, instead of only two long hairs in this position (one on each side), as in *M. musculus*, *M. tenax*, etc.

Length of body 340 μ , its width 170 μ .

Host: English Squirrel (*Sciurus vulgaris*), Exeter, October 1918.

Psoroptes natalensis, sp. n.

♂. Second hair from each side on abdominal lobe fairly long and shaped like a very fine lance, the distal half being distinctly flattened (blade-like), instead of cylindrical as in *P. ovis*, *P. capræ*, *P. cuniculi*, *P. equi* (and also *P. bovis*, according to Berlese's description and figure). Middle hair on lobe long and fine. Outermost hair quite short. Innermost hair very fine and comparatively long.

Length of body (including capitulum and posterior lobes) 420 μ , its width 290 μ .

Material. A number of specimens found on cattle at Richmond, Natal, 1896 (C. D. Soar's collection).

Note.—In the genus *Choriopetes* (including *C. bovis*) the central hairs on the abdominal lobes of the male are modified in much the same way as in this new species, but the flattened portion is very much wider and the pedicles of the tarsi bearing the pulvilli are quite short instead of elongated and segmented, as in *Psoroptes natalensis*, etc.

* The characters of the feet and ear need verification in the case of *Paracynictis*, only dried skins of the genus being available for examination.

LIV.—*The Selection of Helix nemoralis by the Song-Thrush* (*Turdus musicus*). By MAUD D. HAVILAND, Hon. Mem. B.O.U., and FRANCES PITT.

SECTION I. By MAUD D. HAVILAND.

AN article on "Shell-banding as a Means of Protection," by A. E. Trueman, appeared in the Ann. & Mag. Nat. Hist., October 1916, and is of considerable interest, for it deals with the striking habit of the song-thrush (*Turdus musicus*) to break small shells habitually upon certain stones or "anvils," and this habit is rare among birds. At first sight, the author's conclusions seem to give proof of natural selection in operation; but when the matter is examined more closely, it is not so clear, and some of Mr. Trueman's methods invite criticism.

It would have been well if he had given a detailed account of the wide area in which his "anvil" and "control" collections were made. The area is described only as a belt of country on the Magnesian Limestone, some 3 miles long, between certain named localities. *Helix nemoralis* varies almost from one ditch to another, as, indeed, is exemplified in Mr. Trueman's paper, and, unless the control collections were made immediately round their respective anvils, they may be very misleading. In a collection made at Quy Fen, Cambridgeshire—a piece of marshy pasture-land interspersed with clumps of willow and bramble-bushes,—it was found, although exact figures were not kept, that lightly banded snails were more abundant on the open spaces among the short herbage, while the heavily banded specimens predominated in the bushes. If a collection had been made, for instance, only in the open, it would not have been really representative of the snails in the locality in general.

Another weak spot in Mr. Trueman's control collection is that it was formed of dead shells. How can one be sure that the shells were in the same situations and positions as when they were alive? It is much to be doubted whether protective devices are of much avail to any creatures that are preyed upon by ground-feeding birds. Striped coloration is inconspicuous only when viewed from a distance; the pied striping on the snout of the badger or on the neck of the black-throated diver are cases in point. But when a bird sees a snail among herbage at a distance of only a few inches the bands of black and yellow will be clearly defined.

Certainly thrushes seem to destroy plenty of *Helix aspersa*, whose shell appears to be more inconspicuously coloured than that of *H. nemoralis*.

Mr. Trueman's tables do not give an exact idea of the "conspicuousness" of a given shell. For instance, a "two-banded" specimen might answer to the formula (123)(45) and appear nearly black; or it might be described as 00230 and look almost yellow. This would make all the difference to its conspicuousness. But the figures given are certainly curious, and two explanations suggest themselves:—

- (a) The possibility admitted by Mr. Trueman himself in his last paragraph, when he says: "The figures appear to show that banded shells are less liable to be seen—or, at least, to be eaten." The italics are mine.
- (b) That the darker varieties predominate in bushy places and the lighter in the open, where the thrushes generally feed. Hence the birds would find a larger proportion of unbanded shells.

With these ideas in view I made two series of observations in the summer of 1917; I had hoped to continue them in 1918, but circumstances prevented this, and unfortunately neither of them are as complete as they should be.

The first experiments were made on Maidenhead Thicket, in an open grassy place surrounded by bushes, between June 25th and July 2nd. The snails were tethered to pegs by black threads, varying from 6 to 12 feet in length, passed through a hole drilled in the lip of the shell, and the numbers were checked every evening. Snails disappeared on the second and succeeding days, but I did not obtain positive proof that they were taken by thrushes until June 30th. I found a four-banded shell, still fastened to its thread but unmistakably smashed by a thrush, and some yards away was a second four-banded shell, also broken, beside a stone. On the following day, in addition to two three-banded shells which had been carried off altogether, I found three four-banded shells which, with the threads still attached, were lying each beside a stone with the shell smashed, but with the animal uneaten.

For convenience in working, the snails, whose tethering threads became much entangled, were put out in five groups—A, B, C, D, E. Each group consisted of from four to six snails tied to one peg and selected quite haphazard. The groups were all within an area of 25 yards, but A and B were much overhung by bushes, C was a little more exposed, and D and E were quite in the open. Four snails were

taken from A, none from B, three from C, five from D, and five from E, although the two latter groups were not put out until four days after the others. Unfortunately it was not possible to make longer observations, but, as far as they go, they suggest : (a) that the thrushes, so far from choosing the lightly banded shells, actually preferred the four-banded variety, although this was not the most numerous form provided ; (b) that thrushes may break snails which for some reason they do not eat ; (c) that there is a tendency for snails to be taken from the more exposed places. If the distribution of *H. nemoralis* at Quy Fen obtains elsewhere, the latter factor alone might account for the large proportion of unbanded shells at the "anvils" recorded by Mr. Trueman.

A second series of observations was carried out near Cambridge round an artificial piece of water. The place, which is of about 4 acres area and surrounded by fields, is lush-grass thickly interspersed with cypress, privet, and bramble-bushes. In the season in question it was inhabited by one pair of thrushes, who reared two broods there. Collections were made at intervals, with the results set out in Table II. On July 31st anvil I. only was taken. On August 13th it was emptied again, and II., III., and IV. were found. Therefore the numbers for anvil I. on this date represent a proportion of the thrushes' takings for a fortnight. The large proportion of *Helicella cantiana* found broken may possibly be accounted for by the dry weather that prevailed at the time. In August attempts were made to form a control collection, but owing to the drought they were unsuccessful, and further opportunity did not arise until October 15th-21st, when, after long search, living (mostly immature) specimens were found, as recorded on Table III.

While the control collection is thus so small, judgment must be suspended ; but so far there seems no ground for supposing that the banded shells were taken less frequently than the unbanded, nor that, when taken, they were not eaten. After my observations on the tethered snails, I was prepared to find that the heavily banded shells were distasteful to the birds ; but the later observations dispose of this idea, and as these anvils were made in the summer, when insect food was plentiful, it could hardly be that hunger drove the birds to eat unpalatable food.

I should like here to express my indebtedness to Mr. H. H. Brindley, M.A., of St. John's College, for his assistance in forming these collections and for much helpful criticism and advice.

TABLE I.
Snails tethered in Maidenhead Thicket.

Number of Bands.	Number of Snails.	Number of Snails taken.
1 band	7	1
2 bands	7	3
3 "	23	4
4 "	12	6
5 "	20	1
Vars. <i>rubella</i> and <i>castanea</i> (unbanded)	11	2
Total	80	17

TABLE II.
Cambridge.

Formule.	Anvils.												Tot.
	July 30th.				August 13th.				October 21st.				
	I.	II.	III.	IV.	I.	II.	III.	IV.	I.	II.	III.	IV.	
12345 ¹	11	..	..	1	2	1	10	27	5	..	..	..	51
123(45) ²	10	..	..	2	1	..	5	3	..	..	..	..	21
(12)345 ³	1	..	..	4	1	1	..	4	..	..	..	..	11
(12)3(45) ³	1	..	..	3	..	..	..	17	1	..	..	..	22
(12)(345) ³	2	..	..	5	..	2	..	9	..	..	..	..	15
(12345) ³ .....	..	..	..	6	..	1	..	2	1	..	..	..	10
12340 ⁴	11	..	..	7	..	..	..	..	..	..	..	..	18
(12)340 ⁴	1	..	..	8	..	..	..	..	..	..	..	..	9
12305 ⁴	1	..	..	9	..	..	..	..	..	..	..	..	10
12300 ⁴	11	..	..	10	..	..	..	..	..	..	..	..	21
00345 ⁴ .....	..	..	..	17	4	2	1	10	..	..	..	..	34
(12)300 ⁴	1	..	..	11	..	..	..	..	1	..	..	..	13
10345 ⁵ .....	..	..	..	13	..	..	1	..	..	..	..	..	14
02345 ⁵ .....	..	..	..	15	..	2	7	10	..	..	..	..	34
023(45) ⁵ .....	..	..	..	16	..	..	11	5	..	..	..	..	32
103(45) ⁵ .....	..	..	..	14	..	..	1	..	..	..	..	..	15
00340 ⁵ .....	..	..	..	18	..	1	..	1	..	..	..	..	20
00345 ⁵ .....	..	..	..	17	4	2	1	10	..	..	..	..	34
Unbanded var. <i>bellula</i> ⁶	13	..	..	19	2	2	8	8	1	..	..	..	53
Unbanded vars. <i>rubella</i> and <i>castanea</i> ⁶	9	..	..	20	1	..	4	2	..	..	..	..	36
<i>Helicella cantiana</i> ⁷	9	..	..	..	16	..	..	..	..	..	..	..	25
Total	81	..	..	215	31	13	49	118	9	..	..	..	507

¹ 5 separate bands = 11.2 per cent.

² 5 bands with 4+5 fused = 4.1 per cent.

³ 5 bands with fusions = 12.0 per cent.

⁴ "Plain below" = one or more of bands 3, 4, 5 absent = 20.7 per cent.

⁵ "Plain above" = one or more of bands 1, 2 absent = 29.3 per cent.

⁶ Unbanded = 17.5 per cent.

⁷ *Helicella cantiana* = 4.9 per cent.

TABLE III.

Control Collection for comparison with Table II.

Formula.	Number.	Per cent. of total.
12345 ¹	8	13.5
123(45) ²	3	5.0
(12)3(45) ³	1	1.7
00340 ⁴	1	1.7
12340 ⁴	1	1.7
02300 ⁴	1	1.7
00300 ⁴	1	1.7
00000 (<i>libellula</i>) ⁶	4	17.1
Vars. <i>rubella</i> and <i>castanea</i>	6	
<i>H. cantiana</i>	33	55.9
Total	59	

SECTION II. By FRANCES PITT.

At the request of Miss M. D. Haviland, I obtained a young song-thrush in the spring of 1918, and reared it by hand, in order to ascertain whether the thrush has a preference for a particular variety of *Helix nemoralis*, and also if the habit peculiar to the thrush of breaking snail-shells on an "anvil" is instinctive or acquired through experience by each young bird.

When the bird was fully fledged I offered it two examples of *Helix nemoralis*, of formulæ 00000 and 12345 respectively. The thrush paid no attention to them unless they moved, and then it pecked at the protruding tentacles until the snails withdrew into the shells, after which the bird ignored them.

The experiment was repeated the next day, with the same result, except that the bird pecked the shells sharply two or three times.

On the third day four snails were offered—two 12345 and two 00000. This time, when the bird's attack caused the snail to retract, the thrush turned one shell over, looked into the cavity, and shook it vigorously before casting it aside.

At the fourth trial, two days later, five *nemoralis* were offered—two 00000 and three 12345. This time the thrush carried one of the former variety round the cage, and struck it on the ground until it fell from his grasp, whereupon he picked it up again and battered it on a stone. As it did not crack readily, he seized each of the others in turn, and tried in vain to break them. Finally, he took the first snail again, and ultimately broke it open and ate it.

From the foregoing observations I am inclined to believe that the only part of the snail-cracking habit which is

inherited is the impulse to beat living prey on some hard object, although in one instance I saw the thrush hammer a snail on a sofa-cushion. The habit can be perfected by time and practice, and as it grew older the bird became increasingly expert, for the work requires considerable effort, especially when dealing with strong mature shells.

As regards the selection of a particular type of shell, my experiments gave negative results. I never offered more than three snails at one time—formulae 00000, 12345, and (12345). The results, which are summarized in Table IV., seem to show that the snails were selected quite at random, so that any preponderance of unbanded types at “anvils” is not due to selection by thrushes. I offered specimens of both *castanea* and *rubella* to the bird, and the results show that, although a greater number of *castanea* were left unbroken than of other hues, this was due to the stouter shell. As it became more practised, the bird learnt to break them as readily as the more thin-shelled varieties.

Table V. shows the contents of three “anvils” found near Bridgenorth in Shropshire on a roadside bank in a wooded district, and Table VI. shows a control collection made in the vicinity.

From the evidence afforded by this captive thrush, and by the “anvils” in this district, I conclude that the proportions of varieties of *Helix nemoralis* found at the breaking-stones is influenced chiefly by the proportions present in the locality.

TABLE IV.

Helix nemoralis offered to and eaten by Thrush.

Formula.	Offered.	Eaten.	Per cent.
00000.....	56	26	46.4
12345.....	49	21	42.8
(12345).....	39	23	56.4

TABLE V.

“Anvil” Collection from Bridgenorth, Shropshire.

Formula.	Number.	Per cent.
00000.....	5	17.7
12345.....	13	28.8
12(345).....	1	2.2
123(45).....	4	8.8
1(23)(45).....	1	2.2
(12)(345).....	1	2.2
(123)(45).....	7	15.5
(12345).....	10	22.2

TABLE VI.
Control Collection to Table V.

Formula.	Number.	Per cent.
00000.....	14	22·2
00300.....	1	1·5
12345.....	17	26·5
123(45).....	8	12·5
1(23)(45).....	10	15·6
(12345).....	14	25·0

SUMMARY.

The conclusions drawn from the foregoing observations are:—

The selection of snails by thrushes is entirely haphazard, and the evidence does not suggest that one form is more palatable than another.

There is some evidence that many-banded specimens of *H. nemoralis* are more abundant in bushy shaded places.

As the thrushes as a rule prefer open feeding-grounds, it is possible that this may account for the higher proportion of unbanded shells at certain "anvils."

The young thrush does not recognize and crack snail-shells instinctively, but each individual probably learns to do so by personal experience.

L.V.—On the Genus *Lepidobatrachus*, Budgett.
By G. A. BOULENGER, F.R.S.

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THE British Museum has recently received, by way of exchange with the Cambridge Museum of Zoology, the type-specimens of the problematic Paraguayan Frogs discovered by the late J. S. Budgett, and very shortly described by him in the 'Quarterly Journal of Microscopical Science,' xlii. 1899, p. 329, under the names of *Lepidobatrachus asper* and *L. laevis*. I seize this opportunity for expressing an opinion on their systematic position, which had not been dealt with by the author, and for correcting some errors in which he had fallen.

I can see no reason for maintaining the genus *Lepidobatrachus* (etymological justification not stated). On comparing Budgett's diagnosis with that of *Ceratophrys*, one

might think the absence of vomerine teeth and the presence of "two large teeth in dentaries of lower jaw" in the former sufficient ground for generic separation, but both these statements are incorrect. Vomerine teeth are present, forming two small groups between the choanae, and the supposed teeth in the lower jaw are simply bony processes at the symphysis such as are known in several species of *Rana* and *Ceratophrys*. The teeth in the upper jaw are considerably larger than usual, but the same is the case in *Ceratophrys ornata*, *Rana adspersa*, and other Frogs with biting propensities. "Fontanelles in the parietal region" seems in contradiction with the "great development of membrane bones in the head"; I am unable to explain what the author had in view.

Budgett thought his *Lepidobatrachus levis* might be the same species as his *L. asper*, but I have no doubt the two are perfectly distinct, as may be seen from the following notes:—

Ceratophrys aspera, Budg.

Tongue a little broader than long, entire, moderately free behind, with a round central papillose area. Vomerine teeth in two small rounded groups between the choanae; maxillary teeth large; a pair of large, acutely pointed tooth-like processes at the symphysis of the lower jaw. Habit very stout, arm and thigh enclosed in the integument of the body. Head very convex, much broader than long; a rough bony casque surrounding the orbits; snout rounded, profile descending abruptly from the nostrils to the mouth; nostrils close together, 3 times as distant from the tip of the snout as from the eye; latter small, its diameter one-half its distance from the mouth; interorbital space concave, nearly as broad as the upper eyelid; tympanum moderately distinct, as large as the eye, from which it is two diameters distant. Fingers rather slender, pointed, without subarticular tubercles, first shorter than second. Hind limb very short, as long as or slightly longer than head and body; tibia shorter than the foot, $3\frac{1}{2}$ times in length from snout to vent; toes short, pointed, half-webbed, without subarticular tubercles; a narrow tarsal fold and a very large oblique, compressed, sharp-edged inner metatarsal tubercle, the length of which is much greater than that of the inner toe. Upper parts with numerous small warts of unequal size; a narrow, spindle-shaped, granulate dermal bone, about half the length of the head, at a short distance from the latter, above the

anterior vertebræ; lower parts smooth; metatarsal tubercle and tips of toes with black horny sheaths.

Budgett described the colour (in life?) as "dull leaden" above; it is now dark brown, with darker vertical bars on the sides of the head and ill-defined spots and marblings on the body; lower parts white or brownish white, mottled with pale brown on the throat and on the sides.

The two female specimens measure 70 mm. and 60 mm. from snout to vent respectively.

Ceratophrys levis, Budg.

Differs from the preceding in the perfectly smooth head and body, the absence of the bony dorsal shield, the broader and flatter interorbital region, which exceeds the width of the upper eyelid, the longer tibia, which is $3\frac{1}{2}$ times in the length from snout to vent, and the broader membrane between the toes, which may be described as two-thirds webbed.

A single female specimen, measuring 68 mm. from snout to vent.

LVI.—*Descriptions of New Pyalidæ of the Subfamilies Crambinæ and Siginæ.* By Sir GEORGE F. HAMFSON, Bart., F.Z.S., &c.

[Continued from p. 457.]

(12) *Eudorina leucosticta*, sp. n.

Brassy ochreous; head, thorax, and abdomen tinged with reddish brown. Fore wing with the veins streaked with brown; dentate brown subbasal and antemedial lines with whitish diamond-shaped marks between them in and below the cell and a similar smaller mark in the cell before the subbasal line; an obliquely curved discoidal white lunule and a short streak beyond upper angle of cell; the postmedial line oblique, double with whitish marks in interspaces between its two portions, arising from apex and strongly dentate inwards on vein 2; a fine subterminal line, the cilia intersected with brown. Hind wing paler with whitish patch beyond upper angle of cell.

Hab. BR. N. GUINEA, Humboldt Bay (*Doherty*); D'ENTRE-CASTEAUX Is., Fergusson I. (*Meek*), 1 ♂ type. *Exp.*, ♂ 20, ♀ 28 mm.

Subsp. 1. Head, thorax, and fore wing more uniform red-brown, *Ann. & Mag. N. Hist.* Ser. 9. Vol. iii. 35

the last with the white spots much more prominent and additional specks above middle of inner margin and on termen below apex; the lines almost obsolete, the outer edge of the postmedial line appearing as a series of dark points; abdomen and hind wing pale in male, rufous in female.

Hab. MALAY STATES, Padang Rengas; AMBOINA, in Coll. Rothschild.

(5a) *Ommatopteryx discopis*, sp. n.

♀. Head white, slightly mixed with brown; thorax pale brown with a white dorsal fascia on tegulae, the patagia white with brown fascia at middle, the metathorax white behind; abdomen whitish tinged with brown; palpi pale red-brown, white at base and the maxillary palpi white at tips; pectus, legs, and ventral surface of abdomen white slightly mixed with pale red-brown. Fore wing whitish tinged with brown and irrorated with blackish, the post-medial area irrorated with elongate black scales except towards costa and inner margin; a slightly sinuous pale yellow medial band just before end of cell, slightly defined at sides by dark brown, with a narrow white band before it from subcostal nervure to vein 1, and a small black spot in the cell; a small round white spot with black centre at discal fold beyond the cell; subterminal line fine, brown, incurved to discal fold and with some pale yellow before it below costa, below discal fold defined on each side by white; a terminal series of eight minute quadrate black spots from discal fold to tornus, the cilia beyond them metallic cupreous at base and with a metallic cupreous line near base to apex. Hind wing white tinged with red-brown, the cilia white with a red-brown line at middle to vein 2. Underside white, the fore wing faintly tinged with red-brown except on inner area; both wings with faint brown subterminal line to vein 2.

Hab. TRANSVAAL, Pretoria (Janse), 1 ♀ type. *Exp.* 18 mm.

(6a) *Ommatopteryx corsicalis*, sp. n.

♂. Head, thorax, and abdomen pale red-brown mixed with some whitish; antennae pale red-brown; maxillary palpi brown at base, white at tips; palpi white, tinged with rufous except below; pectus, legs, and ventral surface of abdomen white tinged with rufous. Fore wing whitish suffused with red-brown and irrorated with blackish on basal area and just beyond the medial band which is yellow defined at sides by diffused brown and with a narrow white band before it, slightly bent inwards to inner margin; a narrow white subterminal band defined at sides by brown lines, slightly incurved below costa, then oblique to discal fold where it is angled outwards to termen, then inwardly oblique, a small blackish spot beyond it below costa with a slight oblique dark line from it across apical area to near termen; the apex whitish with an oblique dark subapical mark on it; three pairs of minute black terminal spots from vein 5 to above tornus with the cilia beyond them metallic silver at base, the rest of cilia

white with a brown line near base to vein 5. Hind wing white tinged with red-brown, the cilia white with a brown line near base. Underside of fore wing suffused with red-brown, the apical area and termen white.

Hab. CORSICA, Vizzavona (*Walsingham*), 1 ♂ type. *Exp.* 20 mm.

(13) *Ommatopteryx micralis*, sp. n.

♀. Head, thorax, and abdomen fulvous yellow mixed with some white; pectus, legs, and ventral surface of abdomen white. Fore wing white thickly irrorated with fulvous yellow; a narrow inwardly oblique white medial band defined on each side by slight fuscous lines with diffused fulvous yellow beyond them; a narrow curved white band slightly defined by fulvous yellow from costa beyond middle to termen at vein 5; five black points on a slight white band on termen between vein 4 and tornus; cilia with a brown line near base, faint on apical half and some brown at tips. Hind wing white; a slight yellow mark minutely irrorated with black on termen at vein 2; cilia with some black at tips to vein 2 and the hair on inner margin tipped with black and yellow on tornal half. Underside of fore wing suffused with red-brown except on inner area.

Hab. PHILIPPINES, Luzon, Benguet Prov., Irizan, 1 ♀ type. *Exp.* 10 mm.

(14) *Ommatopteryx delicatalis*, sp. n.

♀. Head, thorax, and abdomen white tinged with fulvous yellow, the back of head with a black point, the thorax with a few large black scales; palpi with some blackish towards tips; pectus, legs, and ventral surface of abdomen fulvous yellow, the tarsi banded with brown. Fore wing creamy white irrorated with large black scales, the postmedial area rather more thickly irrorated except at costa which is without black scales; an oblique metallic silver medial line defined on outer side by a bright yellow band, slightly incurved in the cell; a metallic silver discoidal lunule; a metallic silver subterminal line, obliquely excurved and defined on inner side by a bright yellow band from costa to discal fold and with the apical area beyond it suffused with yellow; seven black spots on termen between vein 5 and tornus, rather smaller above and a slight black line on termen towards apex, the cilia metallic silver beyond the spots. Hind wing silvery white. Underside of fore wing tinged with red-brown.

Hab. BR. C. AFRICA, Mt. Mlanje (*Neave*), 1 ♀ type. *Exp.* 22 mm.

(16) *Ommatopteryx brunnealis*, sp. n.

Head, thorax, and abdomen red-brown, the ventral surface of abdomen with some whitish. Fore wing red-brown with a cupreous

gloss and mixed with some whitish especially before and beyond the inwardly oblique rather ill-defined narrow red-brown medial band; an oblique ill-defined whitish band across apical area and a curved whitish mark just before termen towards apex; five black points defined by white on termen between vein 4 and tornus; cilia white with a brown line at middle and some brown at tips. Hind wing white faintly tinged with red-brown, a brown terminal line and a red-brown line through the cilia. Underside of fore wing suffused with red-brown, the costal area deeper red-brown.

Hab. PHILIPPINES, Negros I. (*Whitehead*), 6 ♂, 1 ♀ type. *Exp.* 14 mm.

(1i) *Erupa plumbealis*, sp. n.

Head and thorax dark red-brown glossed with leaden grey; abdomen slightly paler red-brown. Fore wing dark glossy red-brown; an indistinct red-brown antemedial line faintly defined on inner side by greyish, arising at subcostal nervure and strongly excurved between discal and submedian folds; an indistinct red-brown discoidal bar with a slight greyish mark before it at upper angle of cell; an indistinct slightly waved red-brown subterminal line somewhat angled inwards at the veins, defined on outer side by greyish, then by rather diffused red-brown; a series of prominent rather triangular pure white points just before termen from below apex to above tornus; cilia with a whitish line at base. Hind wing rather paler red-brown with a whitish line at base of cilia. Underside dark glossy red-brown; both wings with indistinct curved dark postmedial line.

Hab. COLOMBIA, Choko, Rio Siato, 2 ♂ type, Pueblo Rico, 1 ♀. *Exp.*, ♂ 42-46, ♀ 60 mm.

(2a) *Erupa puncticillialis*, sp. n.

♀. Head and thorax dark glossy red-brown; abdomen rather paler red-brown with slight whitish dorsal segmental lines; pectus with some whitish below the wings. Fore wing glossy red-brown with a series of prominent white points at base of cilia. Hind wing white, the terminal area suffused with red-brown except towards tornus; cilia with a series of slight white spots at base to below vein 2 and some white at tips. Underside red-brown, the hind wing with the cell and inner area white.

Hab. ARGENTINA, Gran Chaco, Florenzia (*Wagner*), 1 ♀ type. *Exp.* 40 mm.

(4b) *Erupa digrammica*, sp. n.

♂. Head, thorax, and abdomen ochreous white suffused with rufous. Fore wing ochreous white suffused with rufous and slightly irrorated with dark brown; a discoidal lunule indistinctly defined by dark red-brown and with an oblique line from it to inner margin with a rather whiter shade before it and oblique

rufous shade beyond it from costa; a slightly crenulate dark red-brown subterminal line with a whiter shade before it and dark points on the veins, excurved below costa; a terminal series of dark brown striæ; cilia with a red-brown line near base and dark tips. Hind wing glossy ochreous tinged with rufous; an indistinct curved red-brown subterminal line and terminal series of dark red-brown striæ. Underside yellowish suffused with rufous; both wings with chocolate-brown discoidal points, curved punctiform postmedial line and terminal series of points.

Hab. PERU, La Oroya (*Ockenden*), 2 ♂ type. *Exp.* 28-30 mm.

(6a) *Erupa schænobina*, sp. n.

♀. Head, thorax, and abdomen pale ochreous; pectus and ventral surface of abdomen white. Fore wing with the apex produced and acute; a rather diffused oblique red-brown line from vein 2 near its origin to inner margin before middle; a diffused slightly waved and very oblique postmedial red-brown line arising near apex and with darker points at the veins; a faint diffused red-brown subterminal line arising from the costa at the postmedial line; a terminal series of dark points. Hind wing white tinged with ochreous especially on inner area; postmedial dark points on veins 6 to 4, then a slight line with a faint diffused subterminal line beyond it; a terminal series of dark points to vein 2. Underside white; both wings with dark discoidal points; fore wing with oblique waved dark postmedial line from costa to vein 4; hind wing with slightly waved subterminal line.

Hab. PERU, Yahuarimayo, 2 ♀ type. *Exp.* 46-60 mm.

(6c) *Erupa unipunctalis*, sp. n.

♂. Head, thorax, and abdomen grey-white tinged with purple-brown. Fore wing grey-white tinged with purple-brown and irrorated with dark brown; a prominent black discoidal point and terminal series of small blackish points. Hind wing glossy whitish tinged with brown; a terminal series of slight brown points to submedian fold. Underside of fore wing and costal area of hind wing strongly suffused with brown.

Hab. BRAZIL, Castro Paraña (*D. Jones*), 1 ♂ type. *Exp.* 38 mm.

(6d) *Erupa arenalis*, sp. n.

♂. Head and thorax whitish tinged with brown; abdomen white tinged with brown except towards base and with some ochreous on dorsum towards base; antennæ brownish except above; palpi white, strongly irrorated with dark brown above; pectus, legs, and ventral surface of abdomen white, the tarsi tinged with flesh-red. Fore wing ochreous white suffused with brown and strongly irrorated with dark brown, the costal edge pure white; a dark brown discoidal point; a postmedial series of dark brown points

between veins 6 and 1, very oblique from vein 4 to middle of vein 1; a curved punctiform brown subterminal line from below costa to submedian fold; a terminal series of slight brown points. Hind wing silvery white, the costal area slightly tinged with brown except towards apex; an indistinct curved brown subterminal line from costa to vein 2. Underside of fore wing and costal area of hind wing suffused with brown except on terminal areas and on terminal half of costa of fore wing.

♀. Palpi irrorated with paler brown above; fore wing much less strongly irrorated with brown and with hardly a trace of the postmedial series of points on the punctiform postmedial line; hind wing wholly white with the subterminal line; underside with the disk of fore wing only tinged with red-brown.

Hab. ARGENTINA, Gran Chaco, Florenzia (*Wagner*), 2 ♂, Santa Fé, Ocampo (*Wagner*), 2 ♂, 1 ♀ type. *Exp.*, ♂ 30-36, ♀ 42 mm.

(8c) *Erupa carnealis*, sp. n.

♀. Head and thorax ochreous white tinged with rufous; abdomen white tinged with ochreous; palpi white, slightly irrorated with brown above; pectus, legs, and ventral surface of abdomen white tinged with ochreous. Fore wing ochreous tinged with rufous and slightly irrorated with dark brown scales except on costal area, the costal edge white; a prominent black discoidal point; a terminal series of slight dark points. Hind wing silvery white with a faint ochreous tinge. Underside white, the fore wing and costal area of hind wing tinged with red-brown.

Hab. PARAGUAY, Sapucay (*Foster*), 1 ♀ type; ARGENTINA, Santa Fé, Ocampo (*Wagner*), 1 ♀. *Exp.* 34-42 mm.

Genus *HYPIESTA*, nov.

Type, *H. argyrogramma*.

Proboscis aborted and minute; palpi downcurved, extending about twice the length of head and fringed with rough hair; maxillary palpi triangularly dilated with scales; frons smooth; antennæ of male laminate and minutely ciliated. Fore wing with the apex rounded, the termen evenly curved; vein 3 from before angle of cell; 4, 5 from angle; 6 from below upper angle; 7 from angle; 8, 9, 10 stalked; 11 becoming coincident with 12. Hind wing with vein 3 from angle of cell; 4, 5 stalked; 6, 7 from upper angle, 7 anastomosing with 8.

(1) *Hypiesta argyrogramma*, sp. n.

♂. Head, thorax, and abdomen white tinged with brown; palpi whitish irrorated with dark brown; pectus, legs, and ventral surface of abdomen whitish suffused with brown. Fore wing whitish irrorated with dark brown to end of cell, the postmedial area

slightly irrorated with red-brown, the terminal area suffused with red-brown; an almost straight red-brown line at end of cell with a minute black discoidal spot on its outer edge; a metallic silvery subterminal line defined on each side by red-brown, excurved below costa; a terminal series of minute black points bisected by white; cilia red-brown and metallic silver. Hind wing white faintly tinged with red-brown. Underside of fore wing and costal area of hind wing suffused with red-brown.

Hab. BR. E. AFRICA, Kikuyu, Nairobi (*Crawshaw*), 1 ♂ type. *Exp.* 16 mm.

(2) *Hypiesta flavirufalis*, sp. n.

♀. Head and thorax yellowish white suffused with rufous; abdomen creamy white, tinged with rufous at base; palpi white irrorated with brown; pectus, legs, and ventral surface of abdomen white suffused with rufous. Fore wing pale yellow tinged and irrorated with rufous, the terminal area strongly suffused with rufous; obscure red-brown streaks in discal and submedian folds; an oblique yellow fascia from apex to lower angle of cell defined on each side by diffused red-brown; two oblique slightly waved brown subterminal lines from vein 6 to inner margin; a punctiform dark terminal line; cilia pale yellow at base with dark line at middle and the tips tinged with red-brown. Hind wing glossy white. Underside white, the fore wing and costal area of hind wing tinged with rufous.

Hab. BR. E. AFRICA, Teita (*Jackson*), 2 ♀ type. *Exp.* 20-24 mm.

Genus *PARERUPA*, nov.

Type, P. diagonalis.

Proboscis aborted and minute; palpi downcurved, extending about twice the length of head and clothed with rough hair; maxillary palpi triangularly dilated with scales; frons smooth; antennæ of male laminate and almost simple. Fore wing with the apex somewhat produced, the termen obliquely curved; vein 3 from well before angle of cell; 4, 5 from angle; 6 from below upper angle; 7 from angle; 8 and 10 stalked; 9 absent; 11 anastomosing with 12. Hind wing with vein 3 from just before angle of cell; 4, 5 stalked; 6 from just below upper angle and somewhat obsolescent; 7 anastomosing with 8.

Parerupa diagonalis, sp. n.

Head, thorax, and abdomen white tinged with brown especially the thorax; palpi white irrorated with dark brown; pectus, legs, and ventral surface of abdomen white tinged with red-brown, the last irrorated with dark brown. Fore wing creamy white thickly irrorated with dark reddish brown; two obliquely placed black discoidal points; postmedial line double, brown, slightly waved,

excurred to vein 4 just beyond the cell, then very oblique to inner margin before middle, an oblique diffused brown streak to it at vein 6 from apex; an oblique diffused slightly waved dark brown line from termen below apex to inner margin beyond middle and a slightly waved red-brown line from below it before termen; a red-brown terminal line with a series of prominent black points on it; cilia white with a red-brown line at middle. Hind wing glossy white. Underside of fore wing except on inner area and the costal area of hind wing suffused with red-brown.

Hab. BR. E. AFRICA, Athi R. (*Betton*), 3 ♀ type, Machakos (*Crawshaw*), 1 ♂; "GERM. E. AFRICA," L. Meru (*Sjöstedt*), 1 ♀; *Exp.* 24-26 mm.

Genus CONIESTA, nov.

Type, *C. aræalis*.

Proboscis aborted and minute; palpi downcurved, extending about twice the length of head and clothed with rough hair; maxillary palpi triangularly dilated with scales; frons with pointed conical prominence; antennæ of male laminate and minutely ciliated. Fore wing with the apex somewhat produced, the termen obliquely curved; vein 3 from well before angle of cell; 5 from just above angle; 6 from below upper angle; 7 from angle; 8, 9, 10 stalked; 11 anastomosing with 12. Hind wing with vein 3 from before angle of cell; 4, 5 from angle; 6, 7 from upper angle, 7 anastomosing with 8.

(1) *Coniesta aræalis*.

Chila aræalis, Hampson. J. Bomb. Nat. Hist. Soc. xxi. p. 1250 (1912).

MADRAS, Nilgiris, Palni Hills.

(2) *Coniesta undilinealis*, sp. n.

♂. Head white; thorax white suffused with brown; abdomen white tinged with brown and with some fulvous at base of dorsum; antennæ, palpi, pectus, legs, and ventral surface of abdomen white tinged with brown. Fore wing white tinged with reddish brown and irrorated with brown; a minute black discoidal spot; post-medial line dark brown, waved, arising at discal fold and strongly incurved below the cell to inner margin before middle; an obliquely curved waved dark brown subterminal line; a terminal series of black points, almost obsolete towards apex. Hind wing glossy white. Underside of fore wing and costal area of hind wing suffused with reddish brown.

♀. Abdomen creamy white; fore wing with the discoidal spot at lower angle of cell, the subterminal line bent inwards to join the postmedial line above inner margin, the fore wing and hind wing to vein 2 with terminal series of black points.

Hab. BR. C. AFRICA, Mt. Mlanje (*Neave*), 4 ♂, 3 ♀ type. *Exp.* ♂ 18, ♀ 22-28 mm.

(3) *Coniesta rufifusalis*, sp. n.

♀. Head and thorax yellowish suffused with rufous; abdomen creamy white with some fulvous at base of dorsum; palpi rufous; pectus and legs white tinged with rufous. Fore wing yellowish suffused with rufous; an oblique slightly waved brown antemedial line from cell to inner margin; a black discoidal point; post-medial line brown, slightly waved, arising below the costa, excurved to vein 4, then incurved to middle of inner margin; an obliquely curved waved brown subterminal line with another line beyond it below vein 2; a terminal series of black points. Hind wing glossy white. Underside of fore wing and costal area of hind wing suffused with brown.

Hab. BR. C. AFRICA, Mt. Mlanje (*Neave*), 3 ♀ type *Exp.* 20-22 mm.

Genus *ADELPHERUPA*, nov.

Type, *A. flavescens*.

Proboscis aborted, minute; palpi downcurved, extending about three times length of head and clothed with rough hair; maxillary palpi triangularly dilated with scales; frons smooth; antennae of male minutely serrate and fasciculate. Fore wing with the apex rounded, the termen evenly curved; vein 3 from before angle of cell; 4, 5 from angle or very shortly stalked; 6, 7 from cell or shortly stalked; 8, 9, 10 stalked; 11 from cell. Hind wing with vein 3 from before angle of cell; 4, 5 from angle or shortly stalked; 6, 7 from upper angle, 7 anastomosing with 8.

(1) *Adelpherupa flavescens*, sp. n.

♂. Head and thorax ochreous yellow suffused with red-brown; abdomen ochreous yellow slightly tinged with red-brown. Fore wing ochreous yellow suffused with red-brown especially on costal and terminal areas; two minute black-brown spots in submedian fold on medial area; an indistinct oblique dark streak from apex to beyond lower angle of cell; a terminal series of black points. Hind wing pale ochreous yellow faintly irrorated with brown; a terminal series of black points to vein 2. Underside yellow, the fore wing suffused with red-brown, the hind wing tinged and irrorated with red-brown.

♀. Fore wing much less suffused and more strongly irrorated with red-brown except at costa, a single medial point in submedian fold, the oblique streak more distinct.

Ab. 1. ♀. Head, thorax, abdomen, and fore wing ochreous white with hardly any red-brown tinge, the last slightly irrorated with brown, the medial points absent, the oblique streak very indistinct; hind wing creamy white.

Hab. N. NIGERIA, Lokoja (*Dudgeon*), 1 ♂, Borgu, Yelwa Lake, (*Migeod*), 1 ♀; BR. E. AFRICA, Shambe (*Betton*), 1 ♂, 3 ♀ type; UGANDA, Gondokoro (*Reynes-Cole*), 3 ♀; "GERM. E.

AFRICA," Dar-es-Salaam, 1 ♀; BR. C. AFRICA, Karonga (*Grogan*), 1 ♀, Mt. Mlanje (*Neave*), 1 ♀; PORTUGUESE E. AFRICA, Mt. Chipirone (*Neave*), 1 ♂. *Exp.* 22-34 mm.

(2) *Adelpherupa albescens*, sp. n.

♀. Head, thorax, and abdomen creamy white, the sides of head and outer edge of patagia faintly tinged with red-brown; palpi and legs suffused with dark red-brown. Fore wing creamy white slightly irrorated with blackish, the costal half tinged with red-brown; a minute black spot in submedian fold below middle of cell and another below end of cell; an oblique dark streak from apex to beyond end of cell; a terminal series of black points. Hind wing creamy white with a terminal series of black points to vein 2. Underside of fore wing and the costal area of hind wing suffused with red-brown.

Hab. BR. E. AFRICA, Alis (*Betton*), 1 ♀; BR. C. AFRICA, Mt. Mlanje (*Neave*), 8 ♀ type. *Exp.* 30-36 mm.

Genus *PARATREA*, nov.

Type, *P. plumbipicta*.

Proboscis aborted and minute; palpi downcurved, extending about twice the length of head and clothed with rough hair; maxillary palpi triangularly dilated with scales; frons with large pointed conical prominence; antennae of female almost simple. Fore wing with the apex rounded, the termen obliquely curved; vein 3 from well before angle of cell; 5 from above angle; 6 from below upper angle; 7 from angle; 8, 9, 10 stalked; 11 anastomosing with 12. Hind wing with vein 3 from near angle of cell; 4, 5 coincident or strongly stalked; 6, 7 from upper angle, 7 anastomosing with 8.

(1) *Paratraea plumbipicta*, sp. n.

♀. Head and thorax glossy black-brown with a red-brown tinge; abdomen red-brown suffused with dark brown and with some deep fulvous at base of dorsum. Fore wing fulvous yellow suffused with deep rufous except on costal area to end of cell and a broad oblique band before the subterminal line from vein 6 to inner margin, the terminal area deep rufous suffused with dark brown; a diffused black fascia on basal part of median nervure with silvery leaden scales beyond it in the cell and below it at base; an indistinct oblique waved black line from beyond upper angle of cell to below lower angle with some silvery leaden scales before it; an oblique slightly waved black subterminal line from below apex to inner margin with diffused silvery leaden scales beyond it; cilia suffused with leaden grey. Hind wing glossy ochreous white suffused with brown. Underside uniformly suffused with red-brown.

Hab. N. NIGERIA, Zungeru (*Macfie*), 2 ♀ type. *Exp.* 26 mm.

(2) *Paratræa griseifasciata*, sp. n.

♀. Head and thorax white tinged with yellow; abdomen ochreous yellow, whitish at base; palpi, pectus, legs, and ventral surface of abdomen ochreous yellow. Fore wing pale yellow, the costal edge white; a grey-brown fascia below base of median nervure and through terminal half of cell; a narrow oblique grey-brown band from lower angle of cell to inner margin before middle; a diffused oblique grey-brown postmedial band from vein 7 to middle of inner margin; a narrow grey-brown subterminal band excurved below costa, then oblique; a terminal series of minute fuscous spots; cilia whitish at tips. Hind wing glossy white with a yellowish tinge. Underside of fore wing and costal area of hind wing tinged with yellow.

Hab. TRANSVAAL (*Janse*), 1 ♀ type. *Exp.* 34 mm.

(1 a) *Diatræa obliquialis*, sp. n.

Both wings with veins 4, 5 stalked.

♀. Head and thorax whitish suffused with ochreous brown; abdomen white, the 2nd and 3rd segments dorsally fulvous; pectus and legs white, the latter tinged with ochreous. Fore wing ochreous tinged with rufous and slightly irrorated with brown; a minute fuscous discoidal spot; an obliquely curved brownish line from apex to inner margin before middle; an obliquely curved reddish brown line from vein 5 before termen to inner margin beyond middle; a terminal series of prominent black points. Hind wing glossy white. Underside of fore wing and costal area of hind wing tinged with rufous.

Hab. ARGENTINA, Corrientes, Goya (*Perrins*), 1 ♀ type. *Exp.* 22 mm.

(1 b) *Diatræa cashmirensis*.

♂. Head and thorax ochreous brown, the frons and patagia except on outer side towards base white; abdomen ochreous white, dorsally suffused with reddish brown towards base; palpi and legs ochreous suffused with brown; pectus white. Fore wing pale ochreous yellow thickly irrorated with large dark reddish brown scales tending to form streaks in the interspaces; traces of a silvery subterminal line; a terminal series of minute black-brown spots. Hind wing white tinged with pale brown, the cilia pure white. Underside suffused with pale red-brown.

Hab. KASHMIR, Dras (*Leech*), 1 ♂ type. *Exp.* 30 mm.

(8) *Diatræa ustalis*, sp. n.

♀. Head and thorax greyish suffused with brown, the frons white; abdomen ochreous tinged with red-brown; palpi, pectus, and legs pale red-brown. Fore wing greyish ochreous suffused with red-brown and irrorated with dark brown; a faint curved dark subterminal line; a terminal series of black-brown points.

Hind wing ochreous tinged with pale red-brown; a fine brown terminal line; cilia brownish white with a slight brown line near base. Underside greyish suffused with red-brown.

Hab. CACHAR, Kanny Koory, 1 ♀ type. *Exp.* 36 mm.

(9) *Diatraea flavalis*, sp. n.

♀. Head, thorax, and abdomen ochreous yellow; palpi above and legs slightly tinged with red-brown. Fore wing ochreous yellow slightly irrorated with red-brown, the terminal area faintly tinged with rufous; a terminal series of dark brown points; cilia with red-brown mixed except at base. Hind wing ochreous white slightly tinged with brown. Underside strongly suffused with red-brown.

Hab. CEYLON (*de Mowbray*), 1 ♀ type. *Exp.* 40 mm.

(10) *Diatraea endothermalis*, sp. n.

♂. Head creamy white with some rufous behind, the antennae and palpi pale rufous; thorax and abdomen yellowish suffused with rufous, the latter with the 2nd segment dorsally deep rufous, the anal tuft creamy white; legs suffused with rufous; pectus and ventral surface of abdomen yellowish white. Fore wing very pale yellow sparsely irrorated with red-brown, the inner area tinged with rufous; a minute dark brown discoidal spot; a rufous point on vein 5 beyond the cell and oblique striga from vein 2 below end of cell; an oblique sinuous rufous subterminal line from vein 2 to inner margin; a terminal series of black-brown points; cilia tinged with rufous at tips. Hind wing creamy white, the inner area slightly tinged with rufous; some dark points on termen towards apex. Underside creamy white.

Hab. PERU, Yahuar Mayo, 1 ♂ type. *Exp.* 40 mm.

(11) *Diatraea calamina*, sp. n.

♀. Head and thorax ochreous suffused with rufous; abdomen whitish suffused with rufous. Fore wing ochreous suffused and slightly irrorated with rufous; some brownish in terminal half of cell and a slight spot below middle of cell; an indistinct curved red-brown subterminal line; a terminal series of black striae defined on inner side by whitish. Hind wing glossy white. Underside of fore wing and costal area of hind wing tinged with rufous.

Ab. 1. Head, thorax, abdomen, and fore wing paler and less strongly tinged with rufous, the last without markings except on termen.

Ab. 2. Fore wing with oblique dark brown shade from apex to below end of cell, then erect to inner margin.

Hab. PUNJAB, Cawnpore (*Betton*), 1 ♀, Moghal Sarai (*Betton*), 1 ♀; BENGAL, Behar, Pusa 1 ♀; U. BURMA, Kinyua (*Bingham*), 5 ♀ type. *Exp.* 26-34 mm.

The larva forms a "cage gall" on maize.

(12) *Diatræa diaperalis*, sp. n.

♀. Head, thorax, and abdomen ochreous tinged with red-brown; palpi darker brown. Fore wing ochreous tinged and slightly irrorated with red-brown; an oblique brown shade from apex to vein 3, diffused to termen; a faint curved pale subterminal line slightly defined on each side by red-brown; a terminal series of black points. Hind wing ochreous white slightly tinged with red-brown; a faint curved red-brown subterminal line. Underside of fore wing suffused with red-brown, the terminal area more ochreous; hind wing with the costal area tinged with red-brown.

Hab. BHUTAN (*Dudgeon*), 1 ♀ type. *Exp.* 30 mm.

(14) *Diatræa louisianalis*, sp. n.

♂. Head, thorax, and abdomen reddish ochreous mixed with some white; palpi irrorated with brown. Fore wing ochreous white suffused and irrorated with pale reddish brown tending to form streaks in the interspaces which are more distinct in and beyond the end of cell and on costal and terminal areas; an indistinct brownish medial spot in submedian fold and a minute black spot at lower angle of cell; a terminal series of minute blackish points. Hind wing white tinged with ochreous; a terminal series of slight blackish points to vein 2. Underside of fore wing and the costal area of hind wing suffused with reddish brown, the former with the costal edge dark brown to beyond middle.

Hab. LOUISIANE Is., St. Aignan (*Meek*), 1 ♂ type. *Exp.* 22 mm.

(15) *Diatræa lunilinealis*, sp. n.

♂. Head and thorax ochreous suffused with rufous, abdomen creamy white with some fulvous yellow on dorsum of 2nd segment. Fore wing ochreous white suffused with rufous; an indistinct waved brown antemedial line from cell to inner margin; a black discoidal point; a rather lunulate brown postmedial line, excurved from costa to beyond lower angle of cell, then incurved to middle of inner margin; subterminal line formed by brown lunules, indistinct and excurved to discal fold, then obliquely curved to inner margin beyond middle and with traces of another lunulate line beyond it before termen; cilia rufous. Hind wing white with an ochreous tinge. Underside of fore wing and costal area of hind wing ochreous tinged with rufous.

Hab. Ceylon, Nawalapitiya (*Pole*), 1 ♂ type. *Exp.* 22 mm.

(16) *Diatræa ignefusalis*, sp. n.

♀. Head, thorax, and abdomen suffused with fiery rufous. Fore wing ochreous suffused with fiery rufous, the veins with whitish streaks, the interspaces beyond the cell with deeper rufous streaks, the costal edge white; the medial area with two slight

brown spots below the cell and two on vein 1, the latter with very oblique rufous stræ from them to inner margin; a minute brown discoidal spot; an indistinct obliquely curved annulate brownish postmedial line; a slight brown terminal line; cilia with a dark brown line near base and white tips. Hind wing silvery white. Underside of fore wing and costal area of hind wing tinged with rufous.

Hab. N. NIGERIA, Borgu, Yelwa Lake (*Migeod*), 3 ♀ type; SUMATRA, Sockar, 1 ♀. *Exp.* 24-30 mm.

(17) *Diatræa lentistrialis*, sp. n.

♂. Head white with a brownish ochreous streak on frons, the palpi suffused with ochreous brown except above; thorax white suffused with ochreous brown; abdomen white with some fulvous yellow on base of dorsum. Fore wing creamy white irrorated with reddish brown, the veins and the interspaces beyond the cell with fine reddish brown streaks; a black discoidal point; an oblique reddish brown line from lower angle of cell to inner margin before middle; postmedial line reddish brown, indistinct and excurved to discal fold, then very oblique; a brown terminal line with series of prominent black points on it; a brown line near base of cilia. Hind wing creamy white. Underside of fore wing suffused with red-brown, the interspaces of terminal area with white streaks; hind wing with the costal half tinged with red-brown.

Hab. ARGENTINA, Gran Chaco, Florenzia (*Wagner*), 1 ♂ type. *Exp.* 16 mm.

(18) *Diatræa albivenalis*, sp. n.

Head, thorax, and abdomen white, the sides of head and the thorax suffused with rufous, the abdomen with the two basal segments dorsally fulvous yellow; antennæ, palpi at sides, legs, and ventral surface of abdomen suffused with rufous. Fore wing white suffused and irrorated with rufous leaving the veins white, the terminal half of cell and the inner area to beyond middle whiter; a fine black terminal line; cilia fulvous yellow at base, with black line near base and some dark scales at tips. Hind wing glossy white. Underside of fore wing and costal area of hind wing tinged with rufous.

Hab. GAMBIA, Bathurst (*Sir G. Carter*), 1 ♂ type; N. NIGERIA, Minna (*Macfie*), 1 ♀. *Exp.*, ♂ 14, ♀ 18 mm.

(19) *Diatræa metaphæalis*, sp. n.

♂. Head and thorax whitish mixed with brown especially the sides of head and tegulæ and the patagia; abdomen whitish suffused with brown; pectus and legs suffused with brown. Fore wing whitish strongly suffused and irrorated with brown leaving the vein white;

a fine black terminal line; cilia white with black line at middle and some brown at tips. Hind wing greyish suffused with brown; a fine dark terminal line; cilia white with a brownish line near base. Underside strongly suffused with brown.

Hab. TRANSVAAL, Bultfontein (*Janse*), 2 ♂ type. *Exp.* 16 mm.

(21) *Diatræa subterminalis*, sp. n.

♀. Head and thorax white slightly mixed with ochreous; abdomen white tinged with ochreous brown; pectus, legs, and ventral surface of abdomen white tinged with ochreous. Fore wing creamy white slightly tinged with rufous, the terminal area more suffused with rufous; a slight black discoidal point; a fine red-brown subterminal line, bent inwards to costa; a terminal series of black points, more prominent towards tornus. Hind wing creamy white tinged with ochreous. Underside of fore wing and costal area of hind wing tinged with rufous.

Hab. UGANDA, Gondokoro (*Reynes-Cole*), 1 ♀ type. *Exp.* 20 mm.

(22) *Diatræa ochrileucalis*, sp. n.

♀. Head and thorax pale reddish ochreous; abdomen white tinged with reddish ochreous; pectus, legs, and ventral surface of abdomen pale reddish ochreous. Fore wing pale reddish ochreous; a minute black point at lower angle of cell; a terminal series of prominent black points; cilia with a slight brownish line near base. Hind wing glossy white. Underside of fore wing and costal area of hind wing tinged with reddish ochreous.

Hab. QUEENSLAND, Cooktown, Cedar Bay (*Meek*), 1 ♀ type. *Exp.* 26 mm.

(23) *Diatræa rufistrigalis*, sp. n.

♀. Head and thorax white slightly mixed with rufous; abdomen white with some fulvous yellow at base of dorsum; antennæ dark brown, the shaft white above; palpi dark brown above; tarsi tinged with brown. Fore wing silvery white striated with rufous; the terminal area with diffused orange-yellow streaks on the veins and traces of a yellow subterminal line; a fine black terminal line; cilia with a black line at middle and some dark brown at tips. Hind wing silvery white with a fine blackish terminal line to vein 2. Underside slightly tinged with red-brown except on inner area of hind wing; the fore wing with slight brownish discoidal spot and faint curved postmedial line.

Hab. BR. C. AFRICA, Mt. Mlanje (*Neave*), 2 ♀ type. *Exp.* 20 mm.

[To be continued.]

LVII.—Description of a new *Dyscophid* Frog from Yunnan.

By G. A. BOULENGER, F.R.S.

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THE family *Dyscophidæ*, with Madagascar as its headquarters, was known to be scantily represented in Burma and Siam (*Calluella*, Stoll.), and Borneo (*Colpoglossus*, Blgr., *Callighutus*, Barbour & Noble). Yunnan may now be added to the range of its distribution in Asia.

Calluella yunnanensis, sp. n.

Habit rather stout, similar to *Microhyla rubra*, Jerd. Head much broader than long; snout rounded, not projecting beyond the mouth, as long as the eye; canthus rostralis feeble; loreal region very oblique; nostril equally distant from the eye and from the tip of the snout; interorbital space as broad as the upper eyelid. Pupil round. Fingers with obtuse tips, first shorter than second, half as long as third; subarticular tubercles moderately large, feebly prominent; three carpal tubercles, median smallest. The tibio-tarsal articulation reaches the shoulder or the temple; heels feebly overlapping when the limbs are folded at right angles to the body; tibia shorter than the foot, $2\frac{1}{2}$ to $2\frac{1}{2}$ times in length from snout to vent; toes moderately long, with slightly swollen tips, the web reaching the tips, but deeply emarginate; subarticular tubercles moderately large, feebly prominent; two metatarsal tubercles, inner oval, somewhat compressed and very prominent, $\frac{2}{3}$ the length of the inner toe, outer smaller, round and flat. Skin smooth, except for some feebly raised glandular ridges which correspond with the outlines of the markings. Pale greyish or pinkish brown above, with a symmetrical vase-shaped brown marking, edged with darker and lighter, from between the eyes to the sacral region; a dark lateral band from the eye to the groin, bordered above by a series of more or less confluent black spots, which extends forwards to the canthus rostralis; limbs with dark cross-bars, one or two on the tibia; lower parts white, mottled with brown, especially on the throat.

From snout to vent 29 mm.

Two specimens from Yunnan Fou, from the collection of Mr. J. Graham.

LVIII.—On a new Variety of *Acanthodactylus boskianus*,
Daud., from the Euphrates. By G. A. BOULENGER, F.R.S.

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I AM indebted to my son, Capt. C. L. Boulenger, for examples of a lizard, referable to *Acanthodactylus boskianus*, caught by himself and Capt. Harrison at Ramadieh on the Euphrates front in 1918, that are of special interest not only as extending the known range of a widely distributed species (Syria, Arabia, North Africa, and the Soudan), but as differing from all other specimens, of which I have examined about two hundred, by a character to which a great importance was formerly attached in distinguishing the species of *Acanthodactylus* and *Eremias*: in 7 out of the 8 specimens collected, the subocular borders the mouth instead of its lower edge forming an angle wedged in between the fourth and fifth or fifth and sixth upper labials; otherwise they agree with the typical form, the *Lacerta boskiana* of Daudin, in the number of scales (38 to 43 across middle of body, 14 or 16 between hind limbs) and of femoral pores (23 to 27 on each side*). The scales round the base of the tail are more numerous (23 to 27 in the fourth or fifth whorl, instead of 18 to 22). The first supraocular shield is divided into 2 or 3 parts, and in four of the specimens there is an agygos shield between the prefrontals. There is nothing special to note concerning the coloration, except the absence of a light vertebral streak; the young has 4 white streaks on the upper surface of the body, 6 on the nape, and one on each side, separated by broader black streaks, each of which may bear a series of round white spots.

The largest male measures 81 mm. from snout to vent, the largest female 80.

The condition of the subocular shield points to this form, which I propose to call var. *euphraticus*, being the nearest to the hypothetical primitive *Acanthodactylus*, according to the views expressed by me in recent papers dealing with the evolution of the Lacertidæ. The three forms into which *A. boskianus* may be divided, although not sharply definable, constitute a highly suggestive gradational series:—

1. Var. *euphraticus* (Euphrates). Subocular usually bordering the mouth; 38 to 43 scales across middle of body,

* In one of the males there are 2-3 additional pores, forming a second series behind the other at the distal end of the thigh.

14 to 16 between the hind limbs; 23 to 27 femoral pores on each side.

2. Forma *typica* (N. Egypt). Subocular not bordering the mouth; 34 to 52 (usually 38 to 43) scales across middle of body, 10 to 16 between the hind limbs; 21 to 31 (usually 22 to 28) femoral pores on each side.

3. Var. *asper* (Palestine, Arabia, Saharan region and Soudan). Subocular not bordering the mouth, 23 to 38 (usually 25 to 35) scales across middle of body, 8 to 14 between the hind limbs; 15 to 27 (usually 17 to 24) femoral pores on each side.

LIX.—Notes on the Ichneumonidæ in the British Museum.—I. By ROWLAND E. TURNER, F.Z.S., F.E.S.

Subfamily Pimplinæ.

Tribe Pimplini.

Certonotus tasmaniensis, sp. n.

♀. Brunneo-ferruginea; mandibulis nigris, antennis 40-articulatis, articulis 29–38 pallide flavis; clypeo, labro, facie lateribus late, orbitis, mesonoto macula utrinque antice maculaque magna quadrata post medium, tegulis basi, mesopleuris fascia sub tegulis macula antice, fascia angusta margine postico, maculaque angulis inferioribus posticis, scutello apice lateribusque, postscutello lateribus, segmento mediano apice late, tergitis 1–6 fascia angusta apicali, coxis apice, trochanteribus, femoribus apice, tibiis apice, tibiis posticis basi anguste, tarsisque anticis flavis; tarsis intermediis posticisque tibiisque posticis in medio uigris; alis subhyalinis, iridescentibus, venis fuscis; terebra valvulisque nigris. Long. 17 mm.; terebræ long. 17 mm.; antennarum long 12 mm.

♀. Clypeus very short, transverse; eyes separated from the base of the mandibles by a distance scarcely equal to half the length of the scape. Face finely and shallowly punctured, with a few delicate transverse striæ below the base of the antennæ and a groove along the inner margin of the eyes; front microscopically punctured; vertex smooth and shining. Pronotum not produced at the angles; mesonotum irregularly and coarsely transversely striated, with a well-marked longitudinal lateral groove on each side; scutellum finely punctured; mesopleuræ shining, finely and sparsely punctured, smooth in the middle. Median segment smooth and shining,

without a basal area, with a broad upper area on each side; spiracle large and elongate, the carinae enclosing the lower and posterior areas not very strongly defined. Abdomen smooth and shining, the emargination of the seventh tergite deep and triangular. Hind tibiae without any trace of a fovea, but with a very minute spine. Areolet triangular; second recurrent nervure sharply bent inwards in the middle, forming a sharp angle. Nervellus geniculate and intercepted above the middle.

Hab. Fern Tree, Mt. Wellington, S. Tasmania, 1300 ft.; January 1913 (*Turner*). 1 ♀.

The antennae are much shorter proportionately than in other species of the genus; the areas of the median segment closely resemble those of *C. similis*, Krieg., as shown in his figure; it also resembles that species in the unarmed angles of the pronotum. In colour this closely resembles *C. nitidulus*, Morl., and may possibly prove to be identical, but Morley gives no clue to the locality of the species, and his type is not in the British Museum; the length given for his species is, however, only 11 mm., and he states that there is a series of foveae on the hind tibiae, not a minute spine as in the present species. The spine is, however, so minute that it might easily be overlooked, but the statement as to foveae could not correctly be applied to the present species. I have been unable to detect the spine on the hind tibiae of *C. annulatus*, Morl., and *C. apicalis*, Morl., though in Morley's table it is said to be present in these species.

Certonotus hinnuleus, Krieg.

Certonotus hinnuleus, Krieg. Zeitschr. Hym. Dipt. i. p. 123 (1901). ♀.

I took a female of this species at Kuranda, N. Queensland, in May 1913; it answers almost exactly to the description. The specimen assigned by Morley to this species with some doubt (*Rev. Ichneum.* ii. p. 32, 1913) is utterly distinct.

Certonotus leeuwinensis, sp. n.

♂. Niger; orbitis late, genis, facio fascia longitudinali nigra, pronoto lateribus, propleuris fascia supra coxas, tegulis, scutello fascia apicali, postscutello macula, segmento mediano macula minuta apicali, tergitis 1-6 fascia angusta apicali lateribusque, tergito septimo apice trimaculato, trochanteribus anticis intermediisque, femoribus anticis intermediisque apice, tibiis anticis subtus, calcariisque albido-flavis; antennis 33-articulatis, articulis 23-31 albidis; mesonoto, lateribus nigris, propleuris, mesopleuris, segmento mediano lateribus, coxis posticis, femoribusque

rufo-ferrugineis; tarsi anticis testaceis; alis hyalinis, leviter infuscat, iridescentibus, venis fuscis.

♀. Mari simillima; scutello in medio, segmento mediano apice, pronotoque lateribus rufo-ferrugineis.

Long., ♂, 8 mm.; antennarum long. 5.5 mm.; ♀, 8.5 mm.; terebræ long. 9 mm.

♂. Clypeus very short; face closely and minutely punctured; front and vertex smooth and shining; eyes separated from the base of the mandibles by a distance nearly equal to the length of the third joint of the antennæ. Hind angles of the pronotum scarcely prominent; mesonotum coarsely transversely striated in front, more obscurely posteriorly, the median lobe with a shallow longitudinal median groove; pleuræ closely and finely punctured. The small basal area of the median segment is much broader than long, with a much larger area broadened from the base beyond it and two large lateral areas on each side, the apical median area being rather indistinctly divided from the apical lateral areas, the whole segment minutely punctured. Abdomen slender, smooth and shining. Hind tibiæ with a minute spine at about one-third from the apex. Nervulus almost interstitial; nervellus straight, without an intercepting vein.

Hab. Yallingup, S.W. Australia, October (Turner); 1 ♂, 1 ♀. Swan River (*Du Boulay*); 1 ♀ in very bad condition. The male is the type.

This is allied to *C. hinnauleus*, Krieg., but the colour is very different and the angles of the pronotum are much less prominent and the mesonotum longer and narrower. The group is well distinguished from others of the genus by the neurulation of the hind wing.

Tribe LISSONOTINI.

Phytodietus celsissimus, sp. n.

♀. Nigra; antennis fusco-ferrugineis, articulis 10 basalibus nigris; pedibus anticis intermediisque rufo-testaceis, coxis flavis; mandibulis, apice excepto, clypeo, facie in medio latissime, macula parva utrinque oculos vix attingente, orbitis internis prope ocellos, mesonoto macula parva post medium, tegulis, mesopleuris macula parva sub alis, scutello antice lateribusque nigro-sinuato, postscutello in medio, metapleuris macula elongata, segmento mediano fascia transversa apicali in medio interrupta, coxis posticis macula basali, trochanteribus posticis, femoribus posticis basi atque apice angustissime, tibiisque posticis basi anguste flavis; segmentis abdominalibus 1-7 fascia angusta apicali albido-flava; alis subhyalinis, iridescentibus, stigmate venisque fuscis.

Long. 8 mm.; terebræ long. 3 mm.; antennarum long. 8 mm.

♀. Antennæ 39-jointed, the third joint half as long again as the fourth. Clypeus and face very finely and closely punctured, the upper part of the face with a deep longitudinal groove on each side near the inner orbits. Front, vertex, and thorax subopaque, smooth; the parapsidal furrows distinct anteriorly; median segment only half as long as the mesonotum, without carinæ, the spiracles small and round. Abdomen smooth and shining, the apical segments minutely punctured on the sides; first tergite about half as long again as its apical breadth, longer than the second segment, second tergite narrowed to the base. Hypopygium not reaching the apex of the abdomen. Valvulæ reddish brown at the extreme apex. Areolet triangular, very shortly petiolate; the inner side of the areolet straight, forming a right angle with the cubitus; the recurrent nervure received close to the apex of the areolet. Nervulus interstitial; nervellus intercepted far below the middle. Tarsal unguis pectinate.

Hab. Mt. Wellington, S. Tasmania, 2300 ft., March 25, 1913 (*Turner*); 1 ♀.

The second tergite is longer and more narrowed to the base than in *P. coryphæus*, Grav., and other Palearctic species, the first tergite is also much more slender; otherwise the species does not differ in any important structural point. In these points it comes very near to *P. astutus*, Grav., which appears to be its nearest ally.

Tribe XORIDINI.

Xylonomus crudelis, sp. n.

♀. Nigra; facie, antennis articulis 11-18, orbitis late ocellum anteriorem non superantibus, vertice macula magna orbitali utrinque, propleuris postice latissime, mesopleuris postice late, scutello macula magna quadrata, postscutello macula transversa, segmento mediano macula triangulari utrinque angulis basalibus, segmento abdominali primo basi, segmentis 1-7 fascia apicali, coxis anticis intermediisque supra, tarsisque posticis, articulo apicali excepto, albidis; terebra pedibusque testaceis, posticis trochanteribus, tibiis apice, tarsisque articulo apicali nigris; alis hyalinis, iridescentibus, venis fuscis, stigmatibus basi albomaculato. Long. 7 mm.; terebræ long. 4 mm.

♀. Clypeus very short, finely punctured; face smooth and shining. Antennæ 24-jointed, joints 3-6 subequal, the five apical joints inserted at a sharp angle to the preceding joints. Eyes parallel on the inner margin; head smooth and shining, cubical and not narrowed behind the eyes. Mandibles short, simple at the apex, not bidentate, eyes separated from

the base of the mandibles by a distance distinctly greater than the basal breadth of the mandibles. Pronotum produced into a distinct acute spine on each side; mesonotum shining, sparsely punctured, notauli deep and crenulate. Median segment with an elongate and rather narrow median area, which is bordered by a transverse carina a little before one-third from the apex of the segment, the basal portion of the area narrowed from the base and strongly contracted at about one-third from the base, the apical portion (or areola) elongate-ovate, truncate at the apex, petiolar area broader than long, lateral carinae well marked; spiracles small and rounded; sides of the segment rugose, produced into a short spine on each side at the apical angles. Abdomen opaque, the dorsal surface very finely and closely punctured-granulate; the first segment petiolate at the base, about three times as long as its apical breadth; second and third tergites with an oblique sulcus on each side from the base to the middle of the lateral margin, and also with an indistinct curved depressed line on each side from the middle of the base to the middle of the lateral margin. Nervulus slightly prefurcal; second recurrent nervure strongly curved outwards and joining the cubitus distinctly beyond the transverse cubital nervure; nervellus elbowed and intercepted close to the middle.

Hab. Kuranda, N. Queensland, May 3-June 20, 1913 (Turner); 1 ♀.

Closely allied to *X. abaddon*, Morley, from Assam, but differs in the colour, especially in the broad interruption of the white of the outer orbits and the apically black median segment, in the narrower first abdominal segment, and in the much less strongly impressed second and third tergites.

Subfamily OPHIONINÆ.

Tribe ANOMALINI.

Exochilum perniciosum, sp. n.

♀. Ferruginea; capite, antennis, prothorace, mesonoto, mesosterno, scutello basi, tibiis posticis dimidio apicali metatarsisque posticis dimidio basali nigris; mandibulis, apice ferrugineis, palpis, facie, orbitis internis infra, orbitis externis linea angusta in parte superiore, vertice macula orbitali utrinque, coxisque anticis flavis; pedibus anticis intermediisque tarsisque posticis, basi excepta, flavo-ochraceis; alis subhyalinis, iridescentibus, venis fuscis.

Long. 14 mm.; antennarum long. 9 mm.

♂. Clypeus and front rather strongly punctured; clypeus subtruncate at the apex; the face with a shallow longitudinal

groove on each side; mandibles bidentate at the apex. Third joint of the antennæ twice as long as the fourth; front rather coarsely rugose, vertex closely punctured. Eyes convergent towards the clypeus, very narrowly separated from the base of the mandibles. Mesonotum very closely rugosely punctured; propleuræ and mesopleuræ closely punctured, the latter rather coarsely reticulate above. Median segment coarsely reticulate, longitudinally depressed in the middle, with lateral marginal carinæ. Abdomen very slender, compressed laterally from the middle of the second segment; first segment very long, the second shorter than the first but nearly twice as long as the third. Basal joint of the hind tarsus a little more than twice as long as the second joint. Second recurrent nervure not interstitial with the transverse cubitus nervure; the external cubital nervure not in a line with the internal; nervulus distinctly postfurcal; nervellus intercepted close to the middle.

Hab. Yallingup, S.W. Australia, October (Turner); 2 ♀♀.

Allied in neuration to *E. scaposum*, Morley, from Queensland, but differs in the black scape, in the somewhat shorter antennæ, and in the ferruginous colour of the median segment and mesopleuræ. In both species the brachial cell is as long as the discoidal. The only other Australian species known to me in which the neuration is similar is *E. atrichiosoma*, Morley, which is closely allied. The hind metatarsi in the present species are shorter than in *scaposum* or *atrichiosoma*. I do not understand why Morley separates these two species so widely in his table; his statement that the "submarginal nervure is opposite or scutellum pale" in *atrichiosoma* is not accurate. In the other Australian species described by Morley under *Exochilum* the discoidal cell is longer than the first brachial, and in *E. australasiæ*, Morley, the second recurrent nervure is interstitial with the transverse cubital nervure, and the external and internal cubital nervures also continuous, thus contradicting the statement in Morley's table "submarginal nervure antefurcal." I have no doubt that *E. australasiæ* has been placed in the wrong genus; it answers well to the characters of *Habronyx*, Först.

Habronyx australasiæ, Morley.

Exochilum australasiæ, Morl. Revis. Ichneumon. ii. p. 75 (1913).

Trichomma elegantula, sp. n.

♂. Niger; mandibulis, apice excepto, clypeo, facie, orbitis late, scapo subtus, linea ante alas, macula parva infra alas, tegulis, scutello, coxis, trochanteribusque, posticis supra ferrugineis, flavis; pedibus anticis intermediisque, tibiis posticis prope basin late, tarsisque posticis articulis tribus basalibus flavo-ochraceis; abdomine lateribus, segmento primo apice, femoribus posticis, tibiisque posticis basi extrema ferrugineis; alis hyalinis, venis fuscis, stigmate pallide testaceo.

Long. 8 mm.

♂. Clypeus not distinctly divided from the face; eyes strongly convergent towards the clypeus; face slightly convex, almost smooth, orbits smooth and shining; eyes almost touching the base of the mandibles. Antennæ about 30-jointed, 5 mm. in length; front finely obliquely rugulose; vertex smooth and shining; eyes as far from the posterior margin of the head as from the posterior ocelli. Mesonotum very closely and rather finely punctured, without notauli; mesopleuræ delicately longitudinally striate; scutellum smooth and shining. Median segment coarsely rugose-reticulate, with a shallow longitudinal groove from near the base to the apex, an obscure longitudinal carina on each side laterally, the sides of the segment coarsely reticulate. Abdomen long and very slender; first segment slightly swollen at the apex, scarcely as long as the second, which is linear, the segments from the third onward strongly compressed laterally. Hind femora slender at the base, reaching their greatest thickness at about two-thirds from the base. Subdiscoideus originating just above the middle of the apical margin of the first brachial cell; nervulus very slightly postfurcal; nervellus straight, without an intercepting nervure.

Hab. Kuranda, N. Queensland, May-June 1913 (Turner); 2 ♂♂.

This is much smaller than the New Guinea species *T. clavipes*, Krieg., and differs in details of colouring, especially in the face and hind tarsi, but in sculpture and neurulation there seems to be little difference. I have not seen *T. clavipes*.

Tribe CAMPOPLEGINI.

Nothanomalon meridionalis, sp. n.

♀. Nigra; palpis pedibusque anticis intermediisque ochraceis, coxis nigris; segmentis abdominalibus primo apice, secundo subtus lateribusque, tertio, quarto quintoque omnino, sexto

subtus, terebra pedibusque posticis, coxis exceptis, brunneo-ferrugineis; valvulis ochraceis, apice nigris; alis hyalinis, stigmatibusque nigris; scapo subtus ferrugineo.

Long. 17-19 mm.; antennarum long. 10 mm.

♂. *Feminae* simillimus, alis leviter infuscatis.

♀. Clypeus, face, and front finely punctured-rugose; vertex opaque, microscopically punctured. Eyes narrowly separated from the base of the mandibles; very little further from each other on the vertex than on the clypeus, widely subemarginate on the inner margins. Antennæ 54-jointed, the third joint distinctly longer than the fourth. Mesonotum very closely and not strongly punctured; notauli shallow, only developed anteriorly; mesopleuræ closely punctured, with a few striæ posteriorly above, the hind margin above smooth and shining; scutellum finely punctured, broadly rounded at the apex. Median segment very long, produced posteriorly as far as the apex of the hind coxæ, rugulose, sparsely covered with white pubescence, deeply longitudinally depressed in the middle; spiracles small and elliptic. Abdomen elongate, laterally compressed; the first segment swollen at the apex and distinctly shorter than the second. Areolet petiolate; second recurrent nervure strongly bent inwards in the middle; nervulus very slightly postfurcal; nervellus straight, not intercepted.

Hab. Eaglehawk Neck, S.E. Tasmania, February 1913 (*Turner*); 1 ♂, 1 ♀. Mt. Wellington, Tasmania, 2300 ft., April 2-6, 1913 (*Turner*); 2 ♀ ♀.

This genus was founded by Szépligeti for a New Guinea species. It is remarkable that I did not take any species of the genus in North Queensland.

Subfamily CRYPTINÆ.

Tribe CRYPTINI.

Mansa volatilis, Sm.

Cryptus volatilis, Sm. Journ. Proc. Linn. Soc., Zool. vii. p. 7 (1863). ♀.

Subsp. *fumipennis*, nov.

♀. Differs from the typical Austro-Malayan form in the colour of the wings, the fore wings being crossed by a broad pale fuscous cloud from the stigma to the anal angle, occupying the whole of the second discoidal and second brachial cells. The stigma is margined with black, not wholly fulvous as in *volatilis*.

Hab. Kuranda, N. Queensland, February 1902 (*Turner*); 1 ♀.

The name *Colganta*, Cam., must sink as a synonym of *Mansa*, as pointed out by Morley.

Cryptus exul, sp. n.

♀. *Nigra*; antennis 32-articulatis, basi rufo-testaceis; articulis 6-10 albido-flavidulis; articulis apicalibus nigris; mandibulis in medio, clypeo, orbitis, segmentis abdominalibus quinto sequentibusque, aliquando quarto etiam, femoribus, tibiis tarsisque rufo-ferrugineis; tarsis posticis articulis secundo tertio quartoque flavescens; stigmatibus basi tegulisque albo-flavidulis; alis hyalinis leviter infumatis, venis fuscis.

♂. *Feminæ similis*; antennis nigris, scapo flavo-testaceo; segmento abdominali quarto aut toto aut dimidio apicali rufo-ferrugineo.

Long., ♀, 9 mm., terebræ long. 3 mm.; ♂, 8 mm.

♀. Antennæ filiform, the apical joint strongly excavated beneath; third and fourth joints about equal in length. Clypeus truncate at the apex; mandible short, ending in two equal teeth. Face closely and finely punctured; front and vertex opaque, finely shagreened. Mesonotum deflexed anteriorly, finely shagreened; the parapsidal furrows distinct, but very shallow; pleuræ finely granulate. Median segment with two transverse carinæ, both somewhat arched in the middle, the basal portion of the dorsal surface before the first carina subopaque and almost smooth; the apical and smaller portion between the two carinæ finely longitudinally striate-rugulose; the posterior angles produced into a stout, rounded, lamelliform spine on each side; spiracles small and round; the apical slope finely granulate. Abdomen smooth and shining; second tergite as long as its apical breadth; valvulæ broad and flattened. Areolet rather large, the transverse cubital nervures parallel, the cubital margin slightly bent in the middle at the point of reception of the recurrent nervure. Outer angle of the discoidal cell blunt; nervulus interstitial; nervellus intercepted far below the middle.

♂. Apical antennal joint not excavated beneath; spines at the apical angles of the median segment absent; first tergite long and slender, second nearly twice as long as its apical breadth.

Hab. Mt. Wellington, S. Tasmania, 2300 ft., March 12-April 6, 1913 (*Turner*); 9 ♀♀, 10 ♂♂.

This is not a typical *Cryptus*, differing in the small round spiracles of the median segment and the parallel-sided areolet. The lamelliform spine at the apical angles of the median segment is a sexual character in this species.

LX.—Two new Gerbils from Sinai.

By OLDFIELD THOMAS.

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I owe to the kindness of the authorities of the Egyptian Zoological Service at Giza the opportunity of examining a number of small mammals from Egypt and Sinai, and among these there are examples of the two following new species of *Gerbillus* :—

Gerbillus floweri, sp. n.

A large species, with comparatively broad skull and large bullæ.

Size of the type, which is old, about as in average specimens of *G. pyramidum*, not so large as the largest examples of that rather variable species. General colour the usual pale "gerbil-colour," the back finely speckled with the minute brown tips to the dorsal hairs; white under surface extending high up on shoulders, and including the whole of the limbs. Soles completely hairy, except just under the heel. Usual postorbital and postauricular white patches distinct. Tail buffy above, white on sides and below; tip missing in type.

Skull proportionally broad, as broad as in a considerably longer skull of *G. pyramidum*. Palatal foramina well open, extending back to the level of the front of the roots of *m*¹. Bullæ larger than in any of the Egyptian or Syrian species, longer but less broadly swollen than in the peculiar *G. valinus* of S.W. Africa.

Dimensions of the type (measured on skin) :—

Head and body 127 mm.; tail (?) ; hind foot 35.

Skull : greatest length 34; condylo-incisive length 30; greatest breadth 19; nasals 13·6 × 3·3; interorbital breadth 6·7; breadth of brain-case 16; bi-meatal breadth 18·2; palatine foramina 6·5; bullæ, diagonal length 11·8, breadth at right angles to last (exclusive of meatus) 6·8; upper tooth-row (considerably worn) 4·5.

Hab. (of type). Wadi Hareidin, extreme northern Sinai, a few miles south of El Arish, about 31° N., 34° E.

Type. Old male. B.M. no. 19. 5. 7. 4. Giza Museum no. 8042. Collected 24th December, 1918, by Capt. S. S. Flower, and presented by the Giza Zoological Service. One specimen.

This gerbil is probably most nearly related to the large Egyptian species *G. pyramidum*, but is distinguished by its broader skull and larger bullæ. It is decidedly larger than the Tripoli *G. tarabuli*.

Named in honour of its discoverer, the well-known Director of the Giza Zoological Museum.

Gerbillus bonhotei, sp. n.

Near *G. andersoni*, but with larger bullæ.

Size and other essential characters as in *andersoni*, but, as compared with specimens from the Nile delta, the coloration throughout of the more bright "gerbil-colour" type, the dorsal colour clear light buffy, less brown, and the white, whether of ear-spots, belly, or feet, more vividly white and more extended in area. Soles well covered with hair except on a small spot under the heel. Upper surface of tail buffy.

Skull very much as in *andersoni*, but the bullæ decidedly and uniformly larger.

Dimensions of the type:—

Head and body 97 mm.; tail 123; hind foot 27; ear 16.

Skull: greatest length 29.8; condylo-incisive length 26; zygomatic breadth 16.6; nasals 11.1; interorbital breadth 6; breadth of brain-case 14.4; palatal foramina 5.1; bullæ (measured as in the previous species) 11.1 x 6.3; upper molar series 4.

Hab. Northern Sinai. Type from Khabra Abu Guzour, S.E. of El Arish. One specimen from Wadi Hareidin.

Type. Adult female. B.M. no. 19.5.7.5. Original number 887 (8046 of Giza Museum). Collected 25th December, 1918, by Capt. S. S. Flower, and presented by the Giza Zoological Service. Four specimens in all.

This species is evidently the representative from a more strongly desert area of the *G. andersoni* of Lower Egypt, and is readily distinguishable by its larger bullæ. In its brightness of coloration it differs from typical *andersoni*, but is imitated by specimens from the Wadi Natron, which are also brighter than those from the dark soil of the delta. All the Egyptian specimens, however, have the same comparatively small bullæ.

It is named after Mr. J. L. Bonhote, Capt. Flower's colleague at Giza, who has done so much to forward our knowledge of the small mammals of Egypt.

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END OF THE THIRD VOLUME.

